

Installation and Owner's Manual

Trimax Powersense 830 Energy Management System

Preface

This is revision B of the Powersense 830 Installation and Owner's Manual. The differences between this revision and previous manuals are as follows:

1. The chapters have been reorganized according to the options available (e.g., Demand Control, Temperature Input, etc.).
2. Sections have been added to include the new capabilities in the Powersense 830 (e.g., 2 holiday types, override logging, etc.).
3. The Serial Communication and Data Logging Manual (formerly Form No. 847-13) has been incorporated into this manual as Chapters 9 and 10.
4. Front panel sequences have been reorganized into a more concise and understandable format.

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The changes implemented per item 2 above affect the programming and operation of the Powersense 830 and options. It is important that this manual be used only in conjunction with model 830's having revision 4.0 software or later. The revision level of the system can be determined in one of the two ways listed below:

1. The keys on the front panel may be used to determine the revision level of the unit. On units with the revision 4.0 software, the number 8 key will have the designation "SPC 1" and the 0 key will have the designation "SPC 2". On earlier models, the number 8 key will have a "SPEC" designation and the 0 key will have only a zero.

2. If the Serial Communication Option is installed, the unit will print the revision level immediately after sign on (e.g., "POWERSENSE 830 REV N.0" the N will have the revision level).

The enhancements to the Revision 4.0 system compared to earlier systems are detailed below:

1. Addition of a second holiday schedule - the model

830 can now retain eighth day and ninth day holiday programs for each circuit.

2. Capability on a daily basis to log the time that each circuit was placed in an override condition during the last 34 days.

3. The ability to assign multiple circuits to a single temperature zone for optimal start purposes. Also, heat and cool optimal start strategies may now be programmed at the same time in order to provide year round optimal start capability.

4. All circuits are now switched ON when the model 830 is powered up and no program exists in memory.

5. The duty cycle program will now accept 0 minutes ON time. When used, this allows the 830 to perform temperature reset with the Temperature Compensated Duty Cycle function.

6. The 48 hour file in the Data Logging Option has been modified to allow user selection of the reporting

interval (range is 4 minutes to 99 hours) instead of the fixed 1 hour format.

7. The Serial Communication printout may be temporarily suspended by typing a CTRL-S character while the terminal or CRT is printing.

8. The Temperature Compensated Duty Cycle function has been changed to include a deadband region. Compensation of a duty cycle is then performed only when the temperature in the assigned zone is outside the deadband.

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I. Energy Management and Load Control

As energy costs continue to climb ever upward, at a pace no one could have predicted a decade ago, the concept of energy management is rapidly being accepted throughout business and industry. Energy management has become a highly sophisticated conservation technique.

Every commercial and industrial concern has found that a substantial share of its operating costs is related to energy costs. Managers have scrambled to reduce energy consumption only to find that even with lower consumption this year's utility bill is still higher than last year's.

The concern is growing, and it is estimated that utility charges for consumption and demand will continue to climb at a 15% annual rate. Oil and gas prices have been climbing rapidly -- the long-term trend is clearly upward. Utilities, struggling to meet increasing demand, have been experiencing serious difficulties as they attempt to develop new power plants and to implement new energy resources.

The utilities, which once warned that they needed a minimum 15% margin of generating capacity above peak usage, now hope they can maintain a 5% cushion during peak demand periods.

The pragmatic solution for business and industry today is to control energy costs through practical, well-planned energy management. The biggest factor in this planned approach is realizing significant dollar savings through load control.

Load control is the automatic ON/OFF control of electrical equipment (loads) to reduce electrical consumption, measured in kilowatt-hours (KWH), and the rate of usage (KW). Most electric utilities charge their commercial and industrial users based on these two separate factors.

The charges for utility costs are analogous to the costs of operating an automobile. Like gasoline, electrical consumption has a relatively constant charge (although it continues to rise year-to-year).

Periodically, drivers (users) must pay for a new supply of gasoline. Drivers are charged for the number of gallons used since the previous fill-up; drivers simply pay for the number of gallons the pump meter registers. A utility bill works in a similar way. The utilities use a kilowatt-hour meter to determine KWH consumption, and the user pays for the amount used since the previous reading of the meter.

There is a hidden factor that determines a share of the consumption costs efficiency. If, as in our example, the car is poorly maintained, driven at high speed or left to idle in inner-city traffic, more gas is consumed than is actually required to perform the task. Comparable industrial business wastes range from poorly maintained equipment to oversized HVAC systems.

In energy consumption, the car has one advantage. When the driver is finished, the engine is shut off and no more gas is consumed. In business and industry, buildings continue to be heated, cooled, or lighted long after the personnel have gone home or the industrial process has been shut down for the night. Automatic load control can significantly reduce this inefficient use of energy.

Unlike the charge for gasoline, there is another, more complicated type of charge set on the rate of consumption during certain key times of the day. This is comparable to being pulled over for speeding. The driver may protest that 95% of the time he drives well under the limit, but only the top speed reached matters. The other speeds or the overall average speed are irrelevant. In a way comparable to the automobile's speedometer, a demand meter measures the demand or rate of electrical consumption by averaging KW usage over 15-30 minute "windows." The highest usage rate in

any one interval for the month is the basis for the monthly demand charge, and the higher the rate, the higher the charge. This discourages high KW use during peak hours.

The demand charge can be a very significant portion of the total utility bill. How the Powersense 830 manages energy use to reduce demand charges is explained in more detail later in this section.

1.1 Basic Theory of Load Control

There are three basic methods of load control:

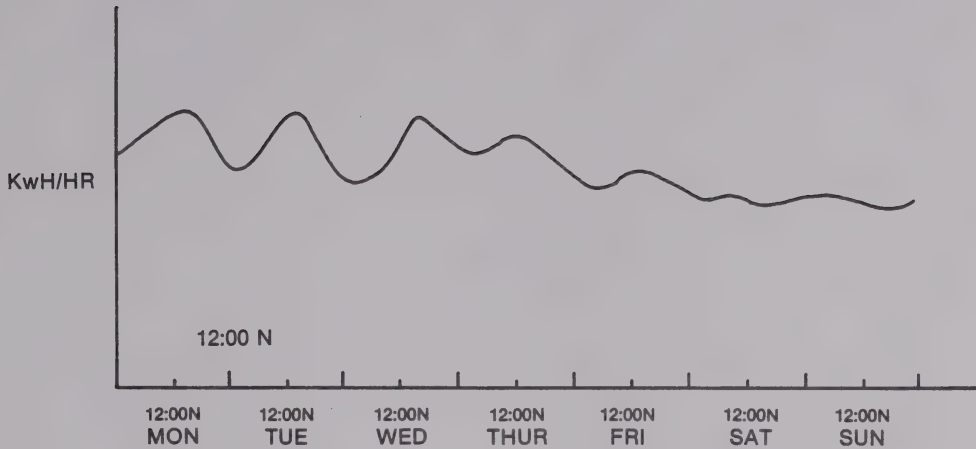
Time-of Day Control, Duty Cycling, and Demand Limiting.

1.2 Time-Of-Day Control

Time-of-Day control is the most readily understood method. Equipment can simply be turned on in the morning when needed and turned off at night. Time-of-Day control saves on consumption by allowing operation of lighting systems and HVAC equipment only when absolutely needed. Figure 1.1 shows a typical consumption rate for an office complex over a one week period, with and without Time-of-Day control.



CONSUMPTION RATE WITHOUT TIME OF DAY CONTROL



CONSUMPTION RATE WITH TIME OF DAY CONTROL

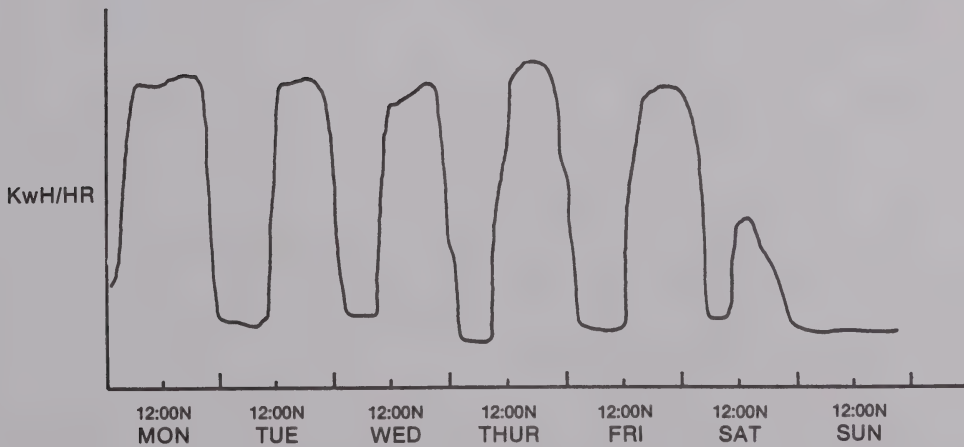


Figure 1.1

Until recently, some managers have accomplished Time-of-Day control through the use of mechanical time clocks. An individual clock is used for each load. This type of control has not been without problems as the clocks have to be synchronized and reset to proper times, have to be reset after a power failure, have to be replaced or repaired if a mechanical failure occurs. In addition, each clock within the plant or complex has to be reset to account for holidays and changes to/from Daylight Savings Time. Holidays alone constitute roughly 5% of the annual business schedule, so controlling power consumption on those days can provide significant savings.

Microprocessor-based energy management systems such as the Trimax Powerwatch 600/515M and the Powersense 815/830 solve all of these problems by maintaining the control of all load scheduling with a single electronic clock. In the event of a power failure, the schedule memory of the Trimax unit is retained by a battery. The clock continues to run during power outages and when power is restored all functions return to normal operation in real time. A delay-restart feature activates each circuit at evenly spaced intervals to prevent load surges.

The programming capabilities of the Trimax units permit flexibility of time-of-day control to allow for such factors as holidays and Daylight Savings Time for year-round, trouble-free time-of-day scheduling.

1.3 Duty Cycling

Another method of load control is called Duty Cycling. While duty cycling generally reduces KWH consumption, it can also provide significant savings in demand charges. Depending upon the area of the country, consumption may or may not be expensive. It can run anywhere from 2 cents to 20 cents per kilowatt-hour consumed. However, demand charges are usually very expensive (from 25-cents to 20 dollars per kilowatt). These charges are intended to discourage high usage during the times of peak load demand.

Through a pre-programmed cycling algorithm, major loads within the facility are not allowed to operate simultaneously. This is accomplished through a rotating OFF strategy.

For example, if a facility has five rooftop package air conditioning units, all five may operate concurrently at some time

during the summer months. It is rarely necessary (if ever) to operate all five compressors simultaneously, to provide a comfortable environment. Each of the five compressors can be cycled off individually on a rotating basis for a set period of time. If continued on a regular basis, Duty Cycling can provide a peak demand reduction equal to the kilowatt rating of one air conditioning unit. Figure 1.2 illustrates the savings effect on Kw demand through duty cycling.

Duty Cycling can also provide the additional benefit of increased equipment efficiency. For example, with one of the rooftop units switched off, the remaining four compressors work in a catch-up mode. Those compressors are more fully loaded, providing better utilization of the air conditioning compressor capacity and increased load efficiency.

1.4 Demand Limiting Control

While Time-of-Day and Duty Cycle control methods are effective energy management strategies for general business and commercial facilities, the Powersense 830 is specifically designed to limit demand in facilities where Duty Cycling may not be appropriate or

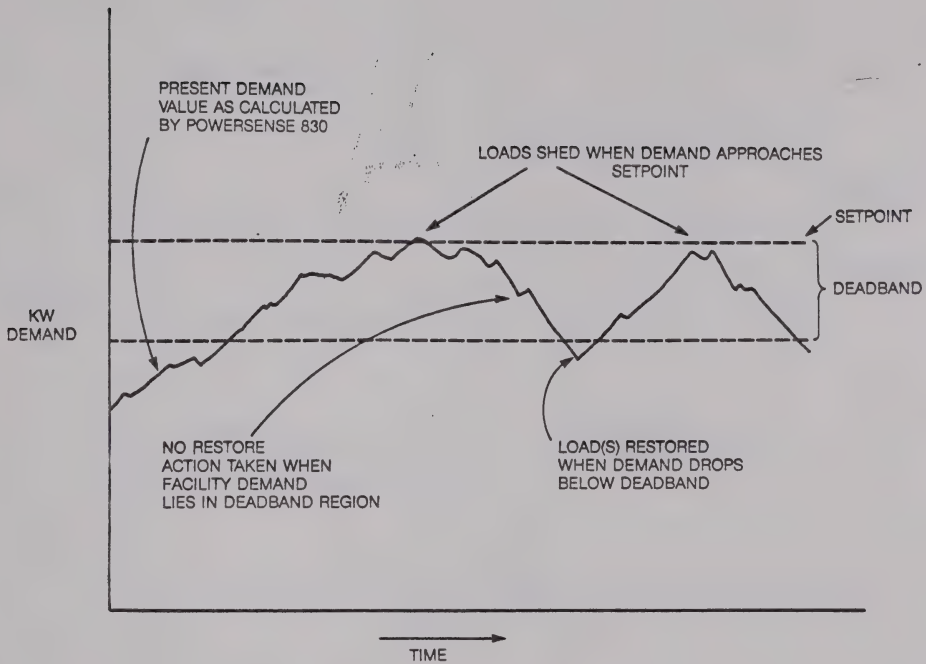


Figure 1.7: The Maximum Allowed Demand Level & Deadband Region

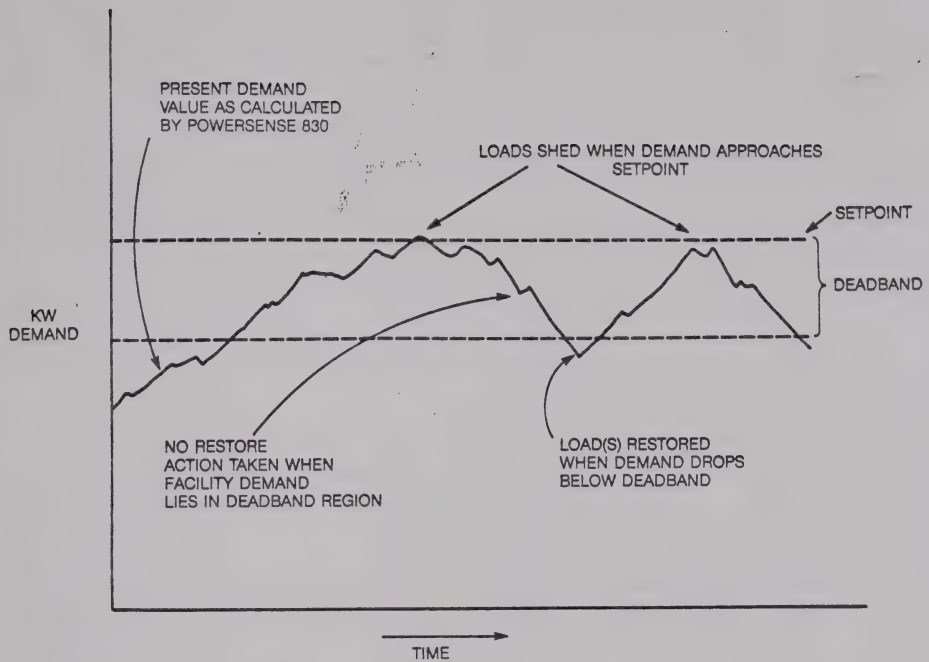


Figure 1.7: The Maximum Allowed Demand Level & Deadband Region

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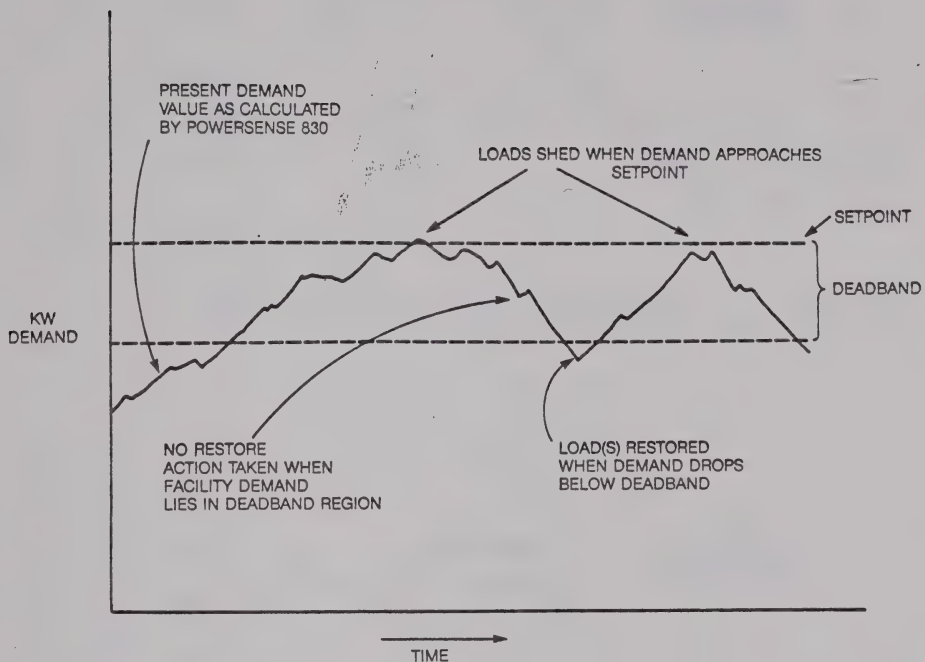


Figure 1.7: The Maximum Allowed Demand Level & Deadband Region

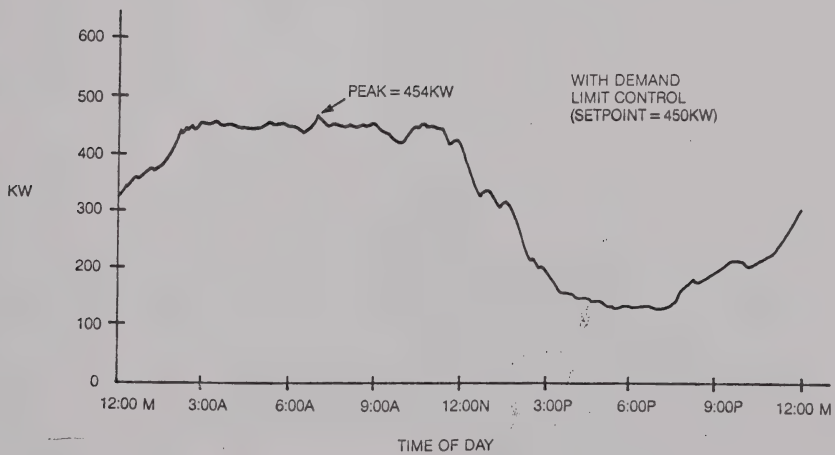
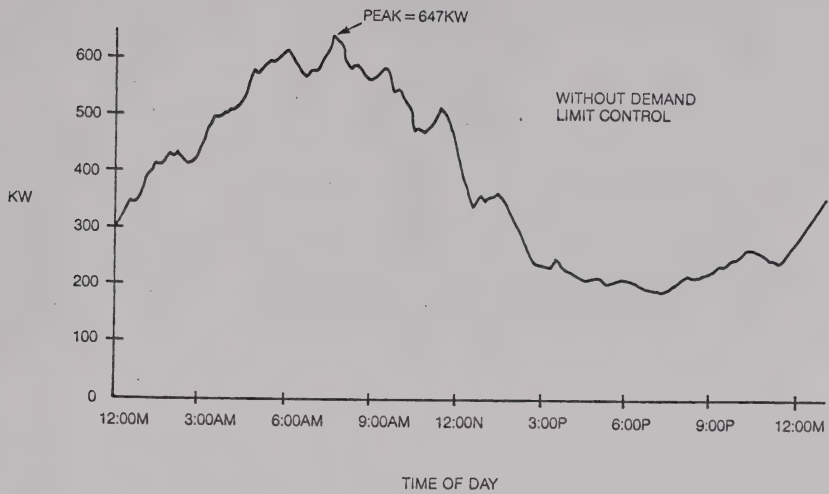


Figure 1.3: Demand Limit Control Application using Load Shedding to reduce demand

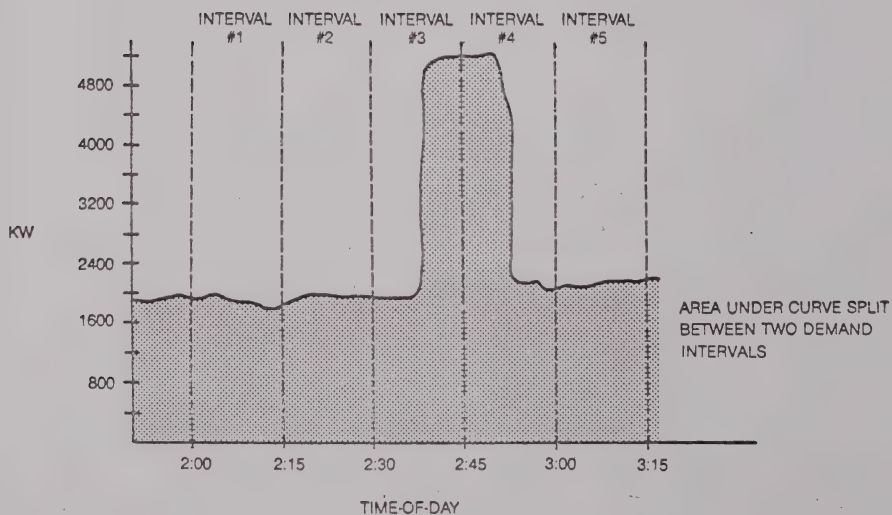
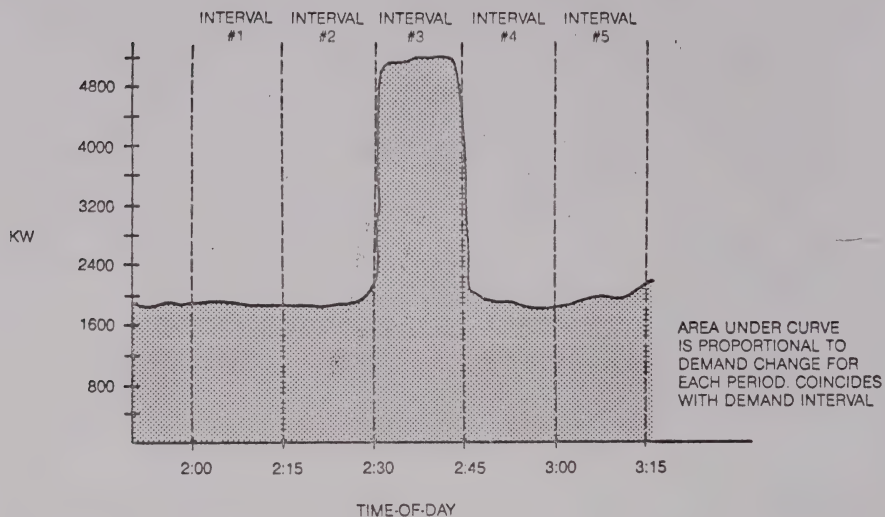


Figure 1.5: Peak Splitting to Reduce Demand with Fixed Interval

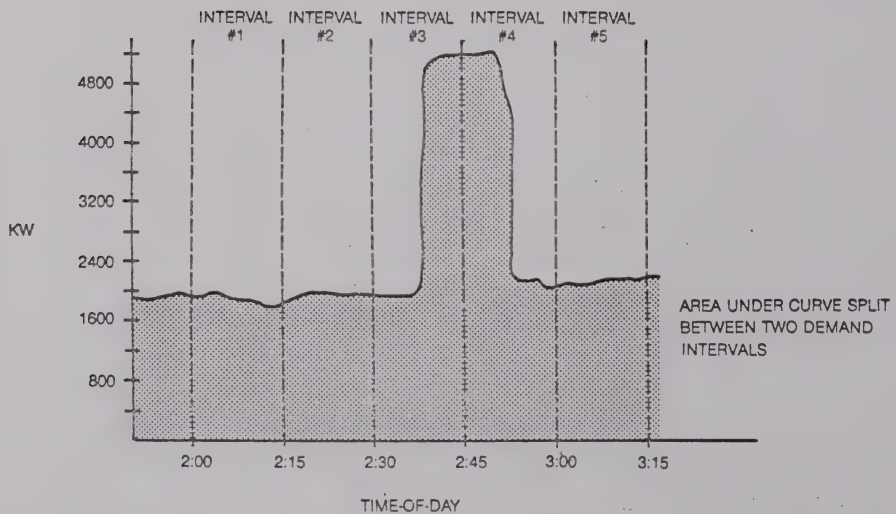
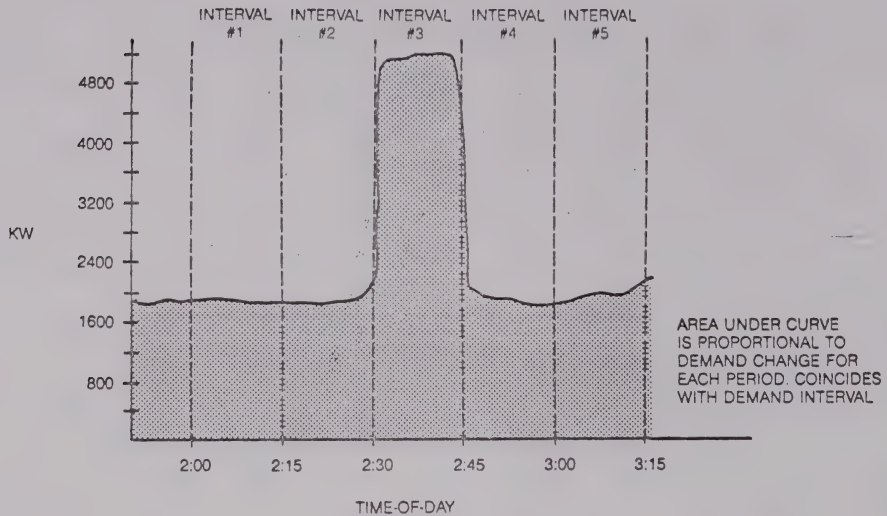


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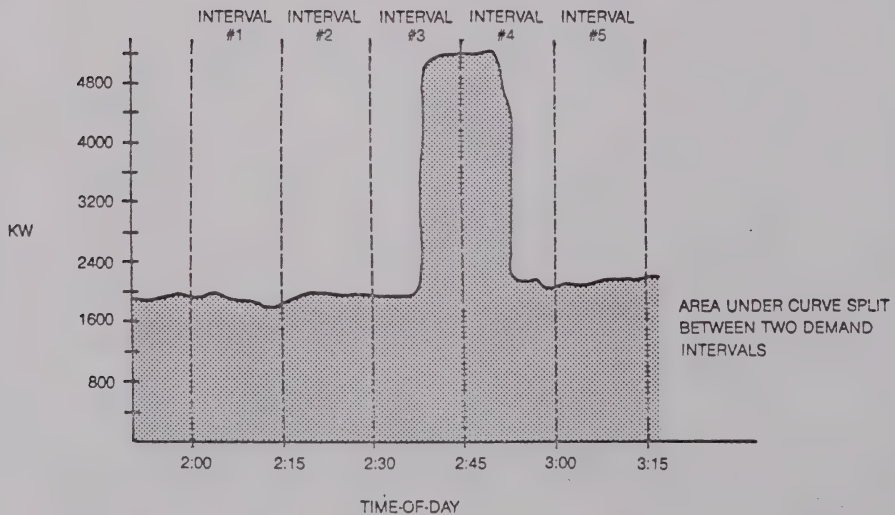
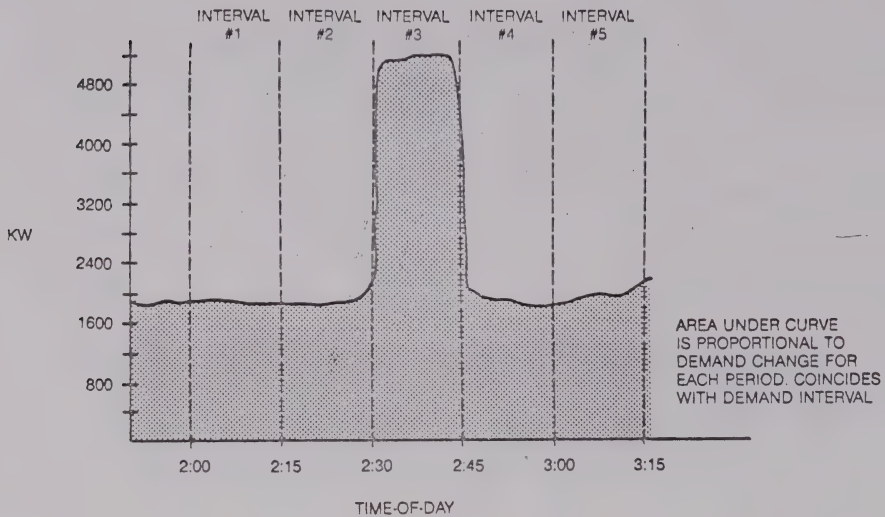


Figure 1.5: Peak Splitting to Reduce Demand with Fixed Interval

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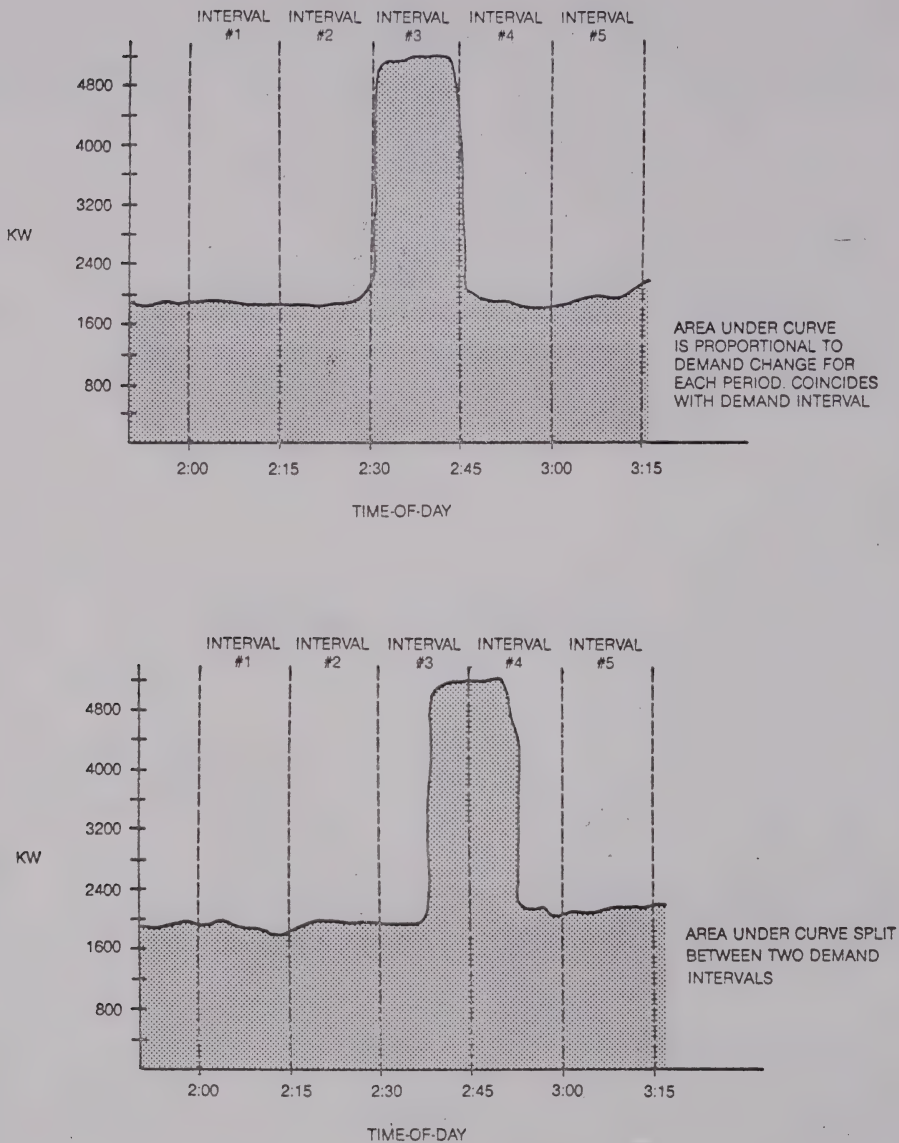


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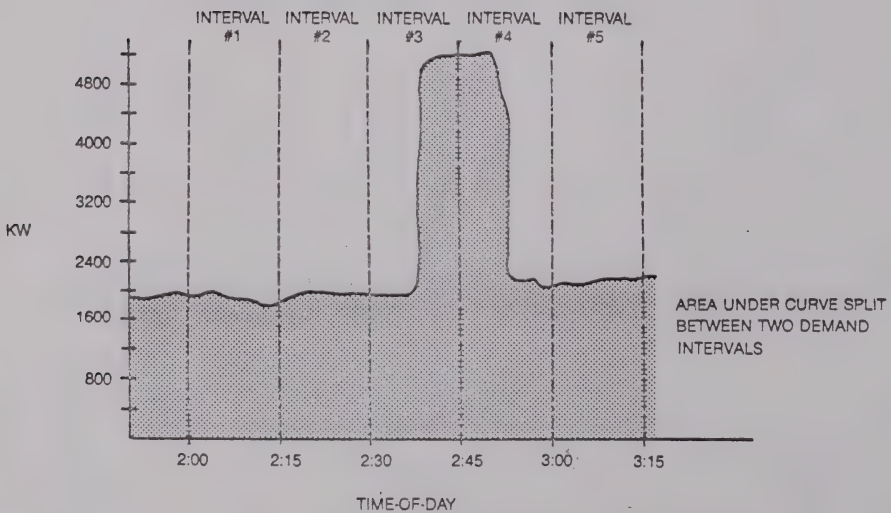
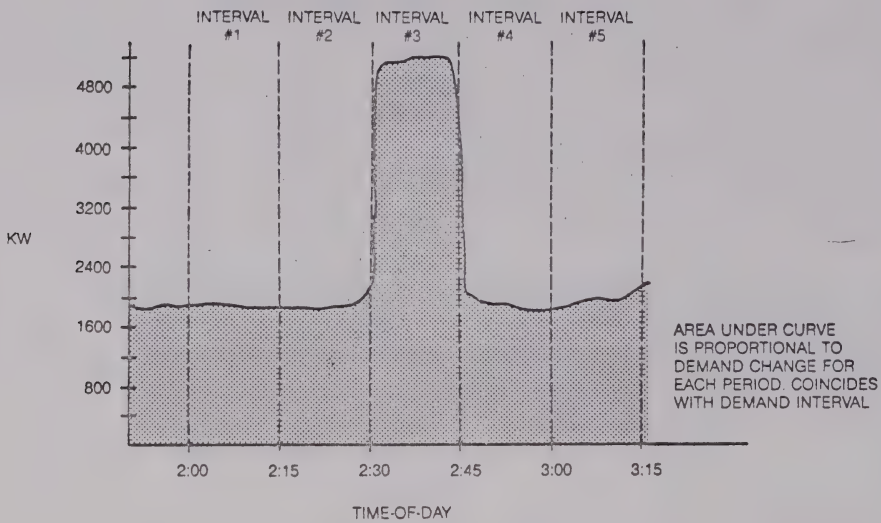
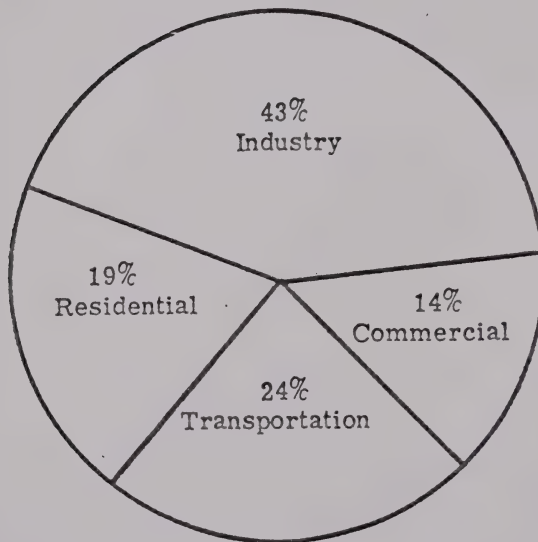


Figure 1.5: Peak Splitting to Reduce Demand with Fixed Interval

ENERGY OVERVIEW

Division of Total United States Energy Consumption

Total energy use in the United States can be divided by business sectors into the areas shown below. Note that the commercial sector consumes about 14 percent of the nation's energy supply.



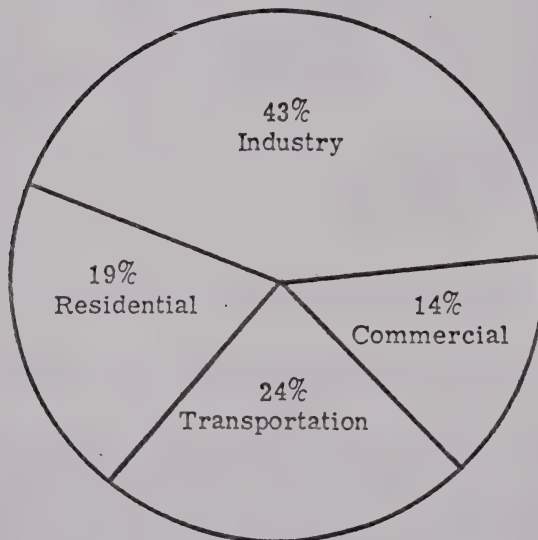
Division of Total United States Energy Consumption

"A Study of the Impact of Reduced Store Operating Hours On Sales, Employment Economic Concentration And Energy Consumption" (October 1974)
Federal Energy Administration.

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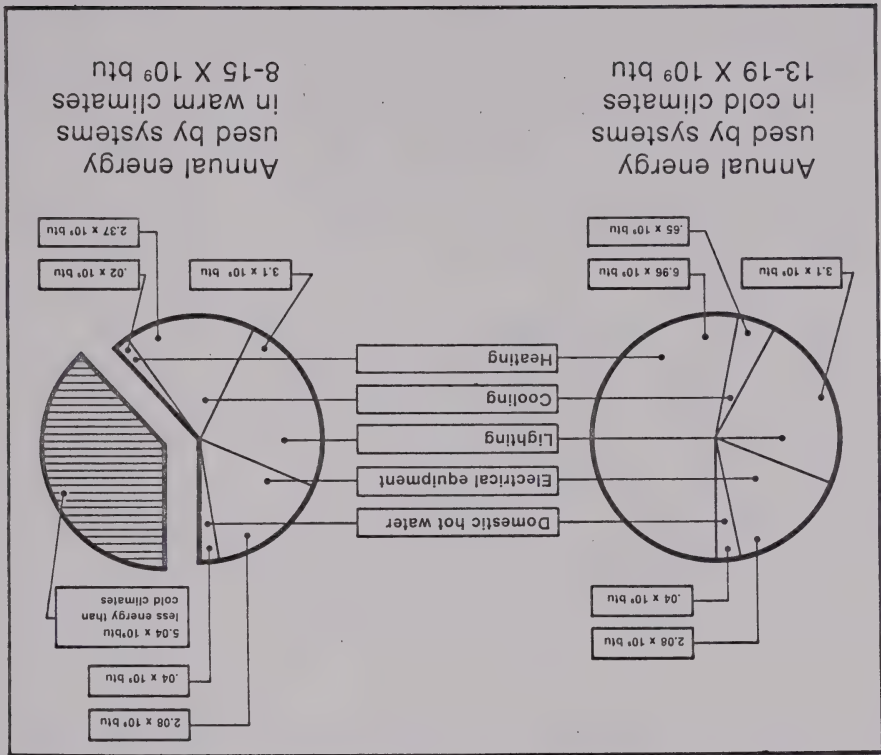
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"A Study of the Impact of Reduced Store Operating Hours On Sales, Employment Economic Concentration And Energy Consumption" (October 1974)
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In mid-climates (2500-6000 degree days), the order of magnitude of energy by systems largely depends upon the type of mechanical and electrical systems and the characteristics of the building structure in which they are installed. The energy required for industrial buildings exclusive of process loads is generally similar in all zones to that required for commercial buildings.

The pie diagrams shown here illustrate the relative magnitude of energy consumption for an office building if erected in a cold climate (Manchester, New Hampshire), and for the identical building if located in a warm climate (Orlando, Florida). Heating is the single largest user of energy for the office building in New Hampshire, and the amount used for cooling is relatively small. In Florida the energy used for heating has decreased and cooling requires the greater amount. (For an explanation of the basis for these diagrams, see Appendix D.)

There is no general rule to determine which part of a particular system accounts for the



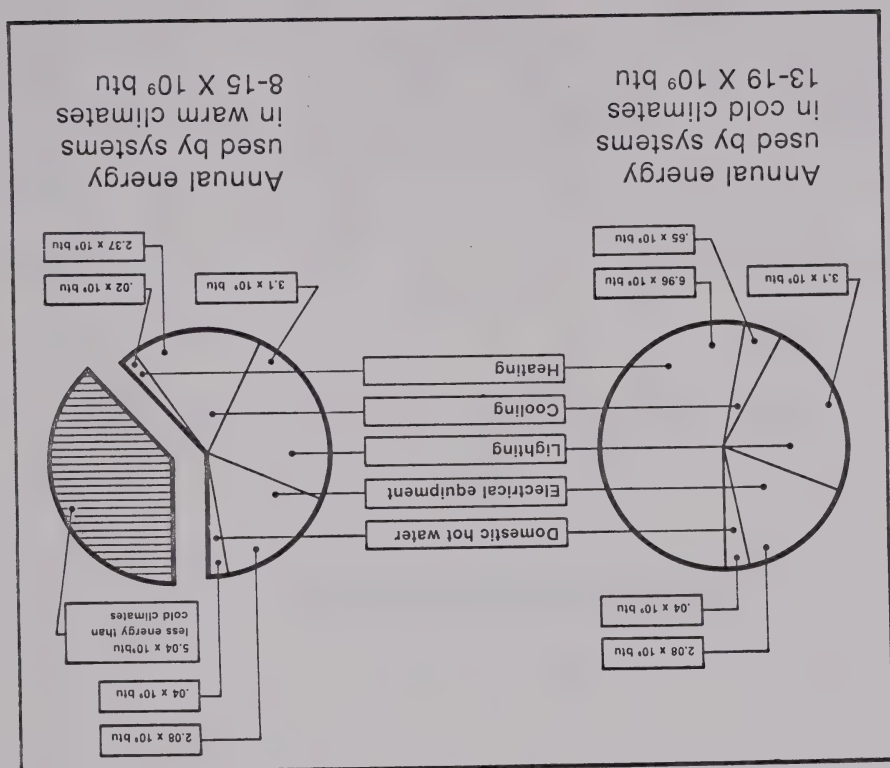
Energy Used by Identical Office Buildings in Warm and Cold Climates.

PREPARING ENERGY USE PROFILES

In mid-climates (2500-6000 degree days), the order of magnitude of energy by systems largely depends upon the type of mechanical and electrical systems and the characteristics of the building structure in which they are installed. The energy required for industrial buildings exclusive of process loads is generally similar in all zones to that required for commercial buildings.

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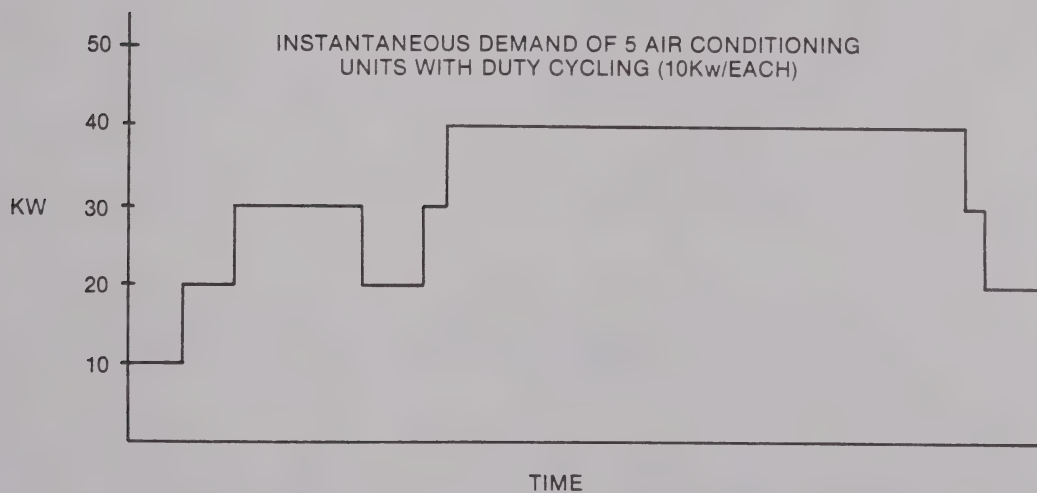
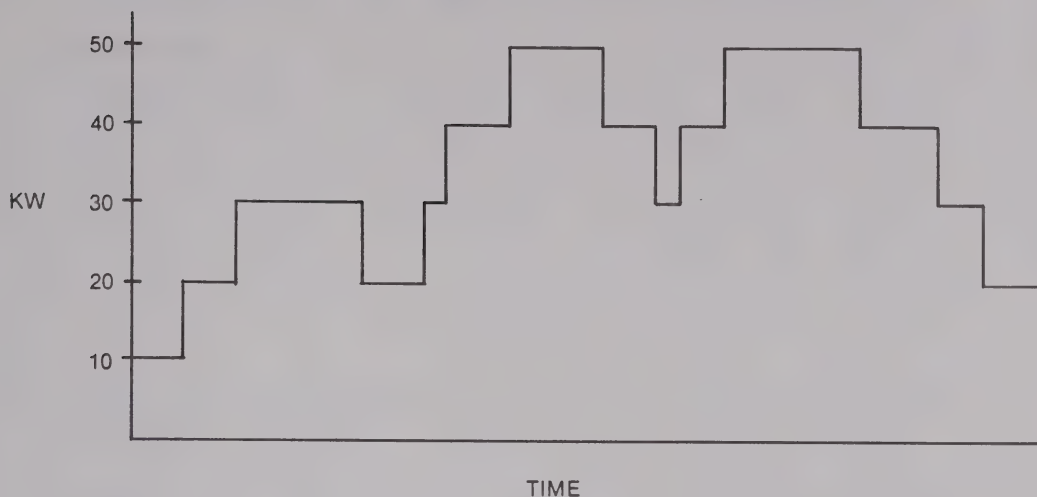
INSTANTANEOUS DEMAND OF 5 AIR CONDITIONING
UNITS WITH DUTY CYCLING 910Kw/EACH)

Figure 1.2

effective. An example would be a manufacturing or process environment where many loads operate on random schedules as required for production. In such a facility, the Model 830 controls various "deferrable" loads such as water heaters, compressors, battery chargers and the like to limit the overall demand of the facility. Loads involved directly in the manufacturing process are generally not controlled in this environment.

In Demand Limiting, a demand controller monitors the power consumed by the facility. The user presets the maximum usage level allowed (setpoint) along with an offset (deadband). As demand crosses the deadband region, the controller is alerted that the facility is approaching its setpoint. Based upon the priorities which the user has entered, the controller begins to shed (turn off) particular loads. As the demand drops below the deadband region, loads are restored.

In such an environment, there is another complicating factor that the Powersense 830 can effectively handle. Often there is HVAC or refrigeration equipment which must be operational for a minimum period of time. Such equipment is controlled within three programmable parameters: minimum shed time, maximum shed time, and minimum on time, all of which are measured in minutes.

Those parameters, for example, might be set in the following way:

Min shed	5
Max shed	20
Min on	8

In this example, the equipment is switched off (shed) as the setpoint is approached, based on its priority, for a minimum of 5 minutes. If the demand level drops to within an acceptable margin, the equipment is switched back on (restored). However, if an acceptable margin is not reached, the equipment remains shed for up to 20 minutes. In either case, once the equipment is restored, it will remain operational for a minimum of 8 minutes before additional shed operations regardless of its priority.

Figure 1.3 shows the effect of Demand Limiting control.

1.5 The Fourth Option

A fourth method of control, called Optimal Start of HVAC equipment, has gained wide acceptance in the Energy Management Industry.

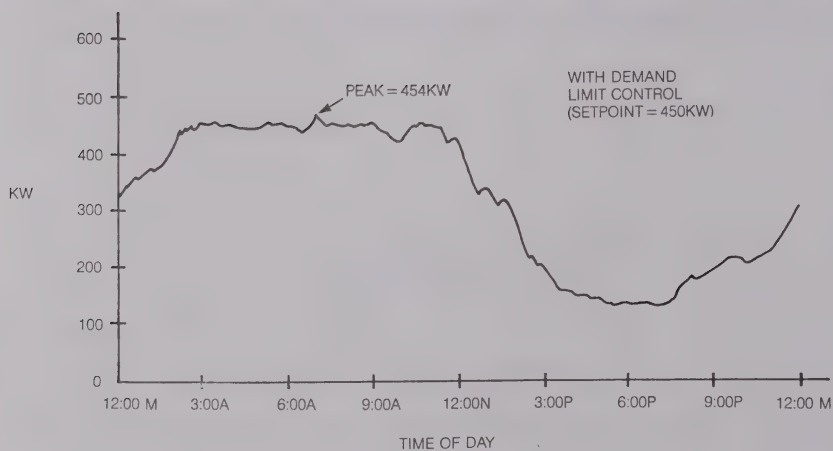
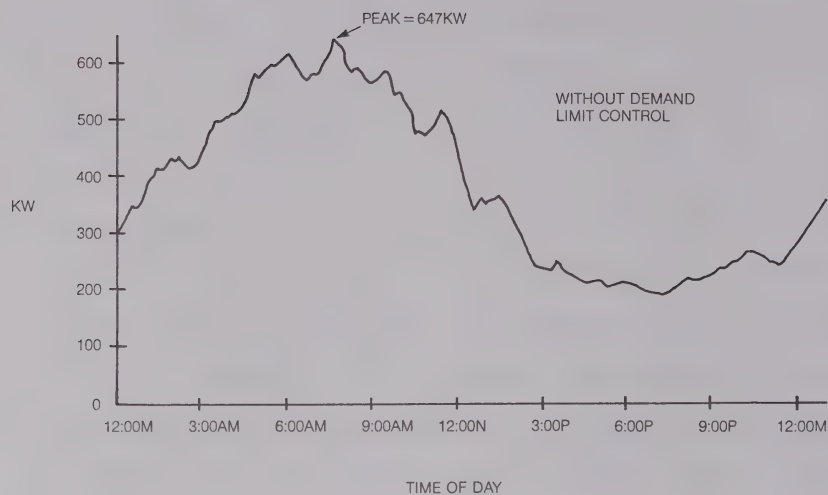
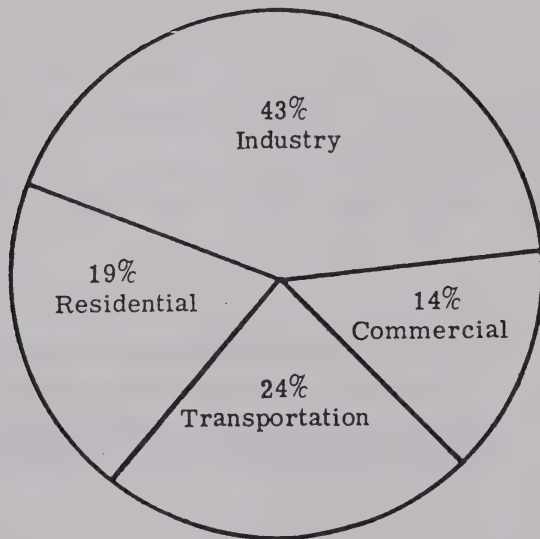


Figure 1.3: Demand Limit Control Application using Load Shedding to reduce demand

ENERGY OVERVIEW

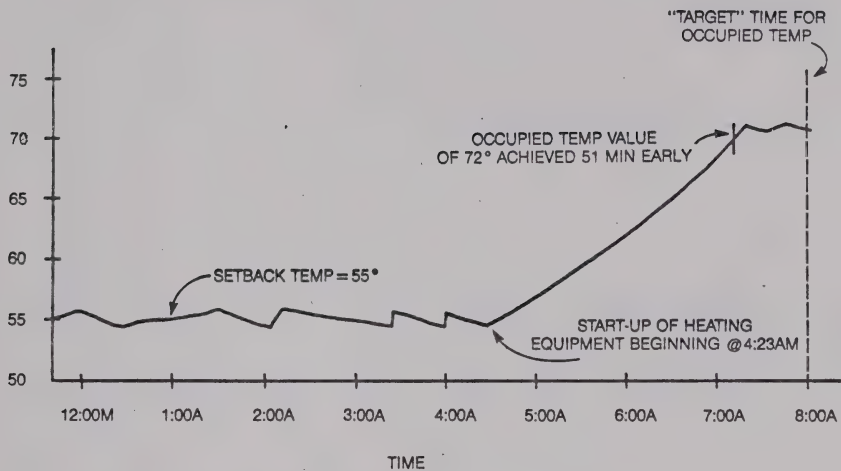
Division of Total United States Energy Consumption

Total energy use in the United States can be divided by business sectors into the areas shown below. Note that the commercial sector consumes about 14 percent of the nation's energy supply.



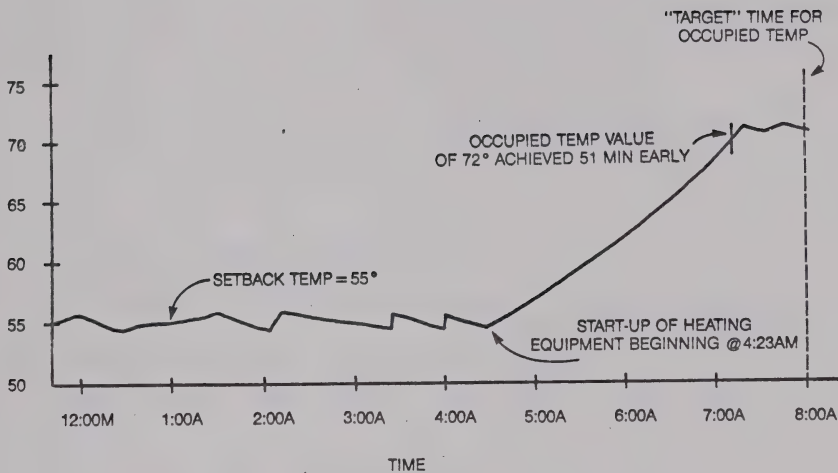
Division of Total United States Energy Consumption

"A Study of the Impact of Reduced Store Operating Hours On Sales, Employment Economic Concentration And Energy Consumption" (October 1974)
Federal Energy Administration.



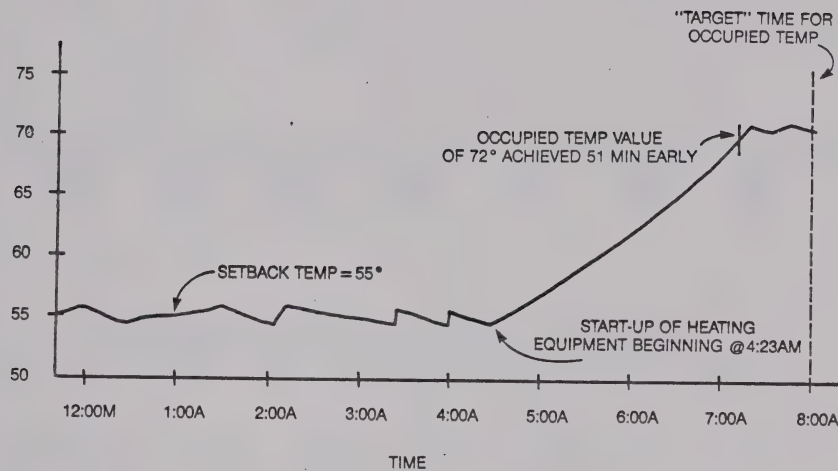
1. OUTSIDE TEMPERATURE IS 25°F AT 4:23AM
2. OCCUPIED TEMPERATURE IS ACHIEVED 51 MINUTES EARLY
3. SECOND OCCURANCE OF 25°F OUTSIDE AIR TEMP WILL RESULT IN START-UP OF HEATING EQUIPMENT AT 5:14AM (51 MINUTES LATER) IN ORDER TO CORRECT FOR REACHING OCCUPIED TEMP EARLY

Figure 1.4: Powersense 830 Self Tuning Optimal Start Feature



1. OUTSIDE TEMPERATURE IS 25°F AT 4:23AM
2. OCCUPIED TEMPERATURE IS ACHIEVED 51 MINUTES EARLY
3. SECOND OCCURANCE OF 25°F OUTSIDE AIR TEMP WILL RESULT IN START-UP OF HEATING EQUIPMENT AT 5:14AM (51 MINUTES LATER) IN ORDER TO CORRECT FOR REACHING OCCUPIED TEMP EARLY

Figure 1.4: Powersense 830 Self Tuning Optimal Start Feature

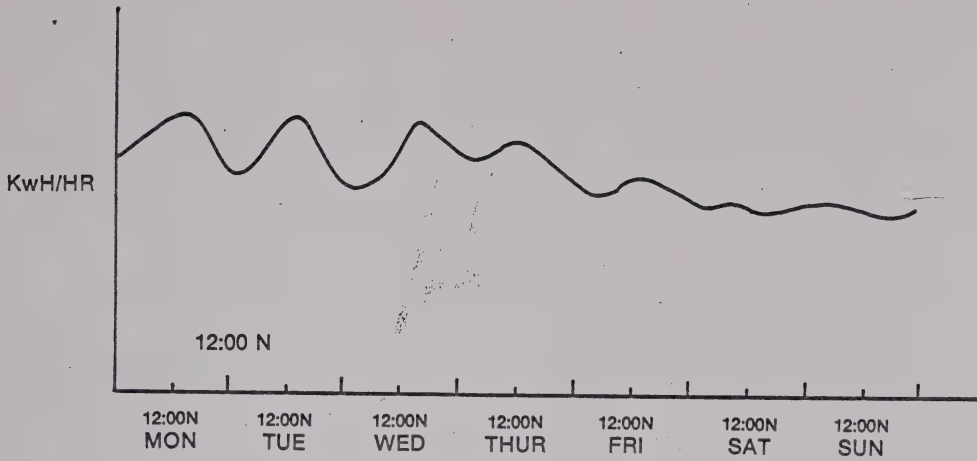


1. OUTSIDE TEMPERATURE IS 25°F AT 4:23AM
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Figure 1.4: Powersense 830 Self Tuning Optimal Start Feature

X

CONSUMPTION RATE WITHOUT TIME OF DAY CONTROL



CONSUMPTION RATE WITH TIME OF DAY CONTROL

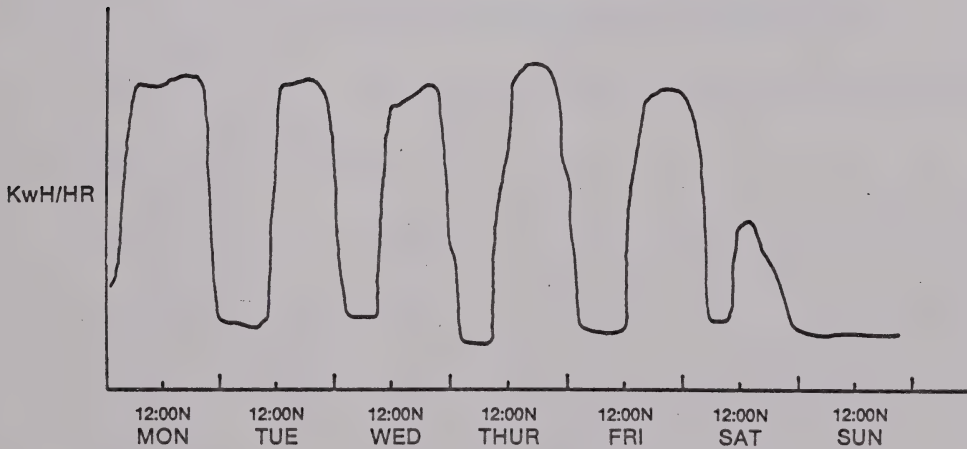


Figure 1.1

INSTANTANEOUS DEMAND OF 5 AIR CONDITIONING
UNITS WITH DUTY CYCLING 910Kw/EACH)

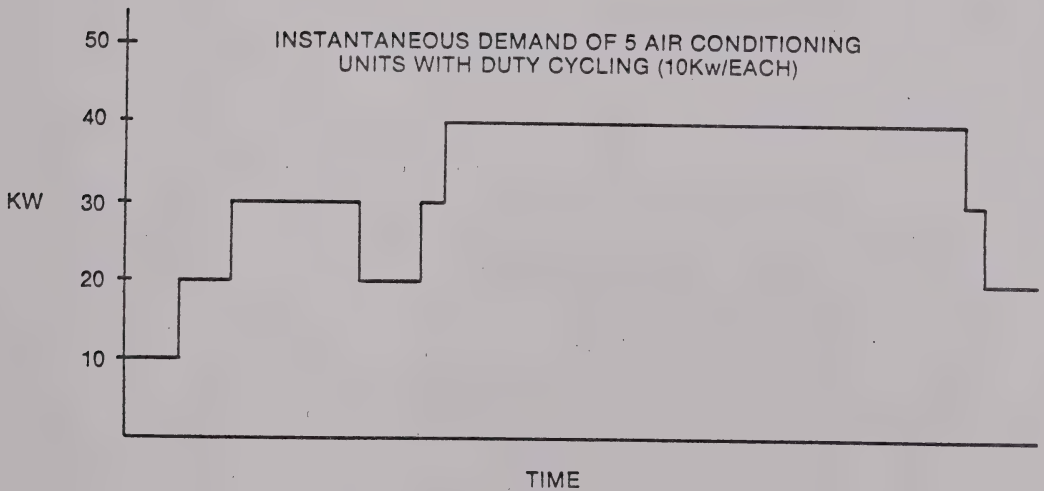
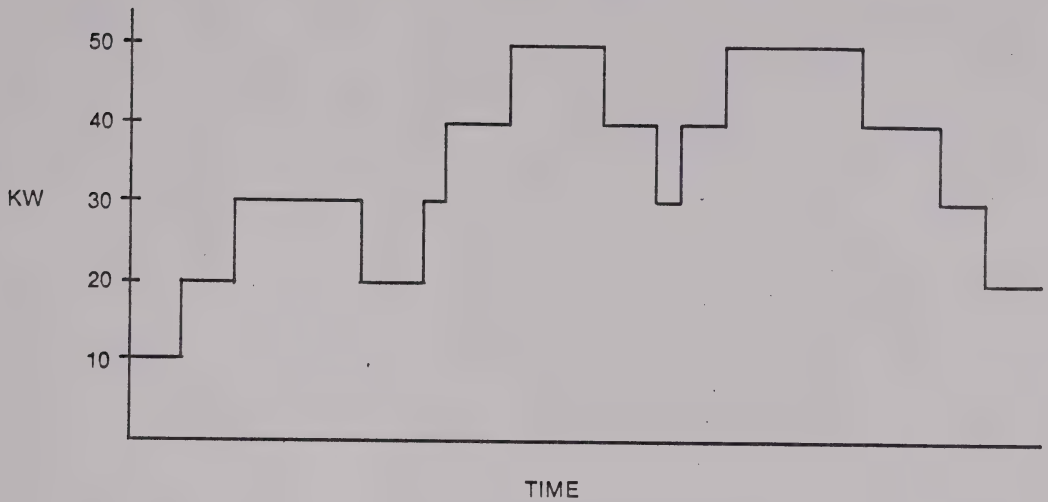


Figure 1.2

INSTANTANEOUS DEMAND OF 5 AIR CONDITIONING
UNITS WITH DUTY CYCLING 910Kw/EACH)

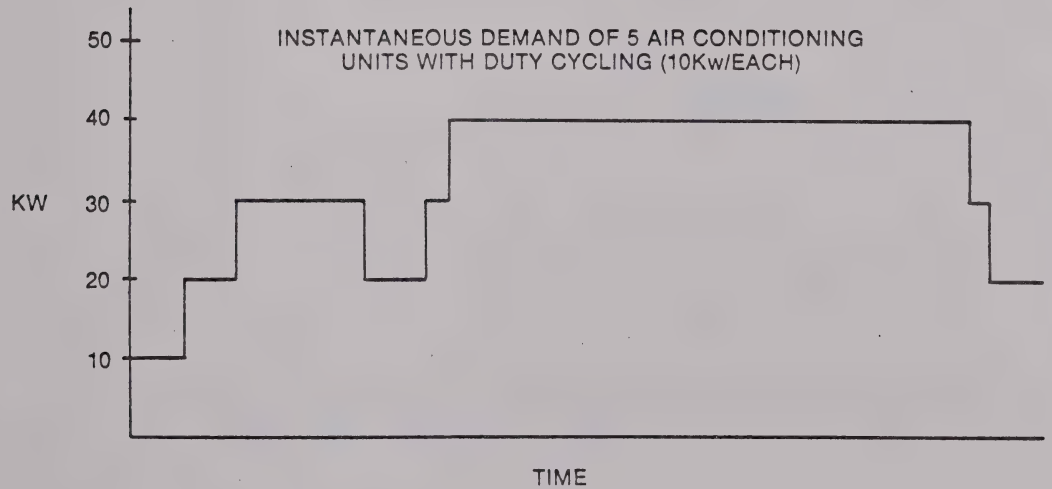
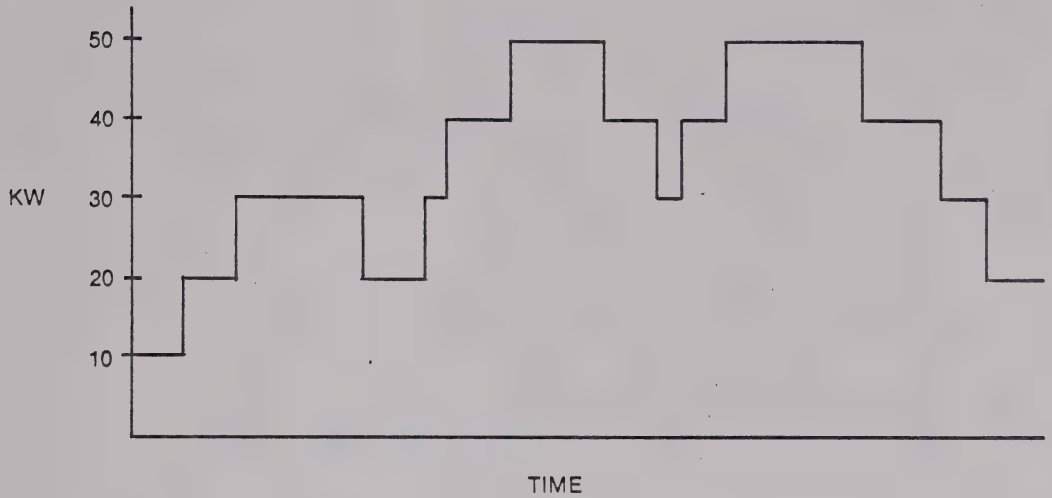


Figure 1.2

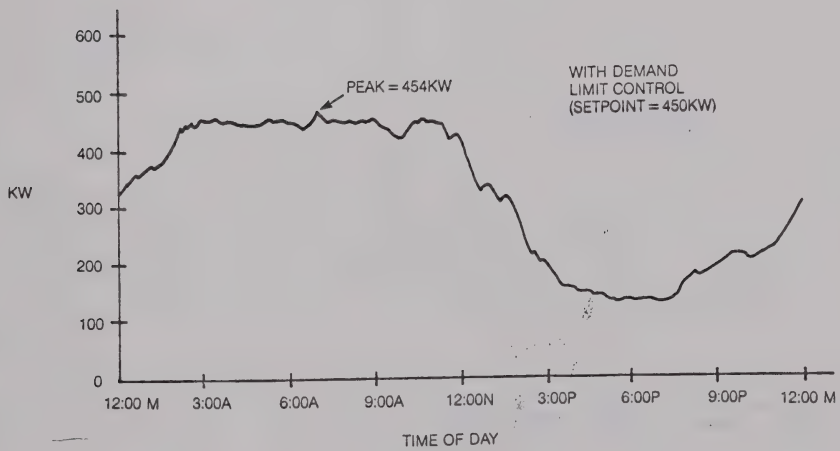
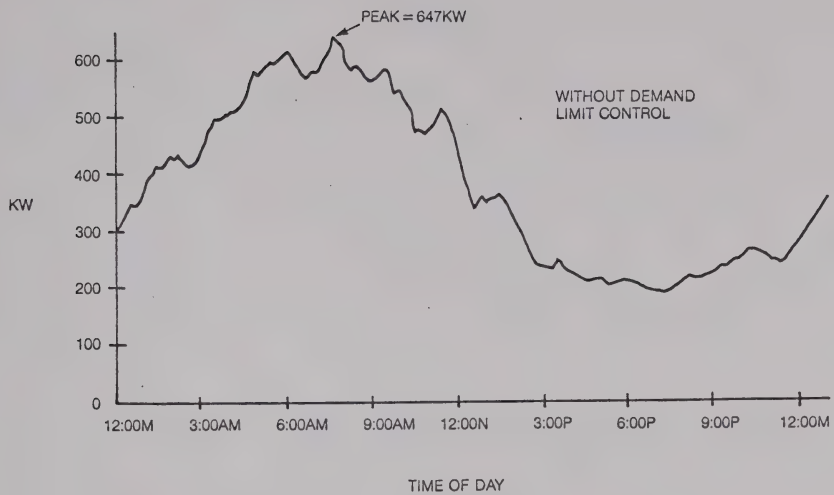


Figure 1.3: Demand Limit Control Application using Load Shedding to reduce demand

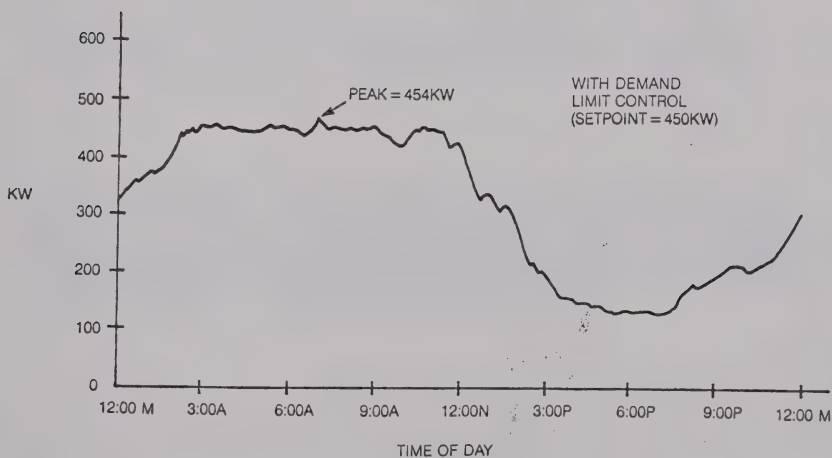
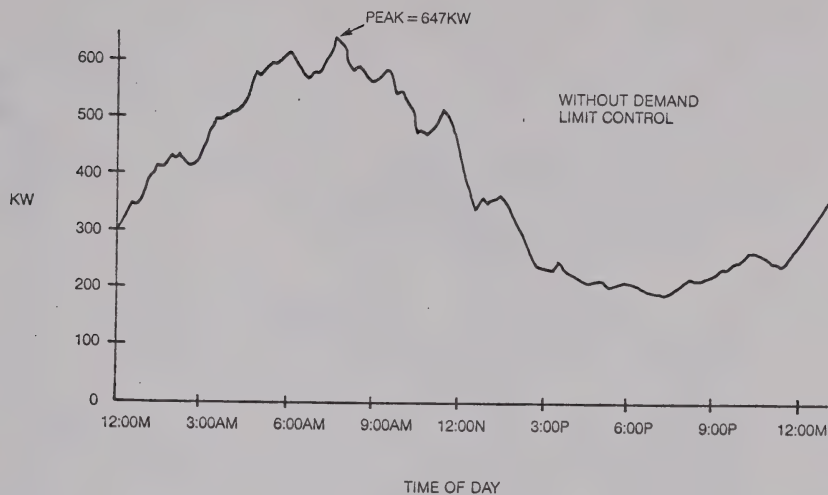
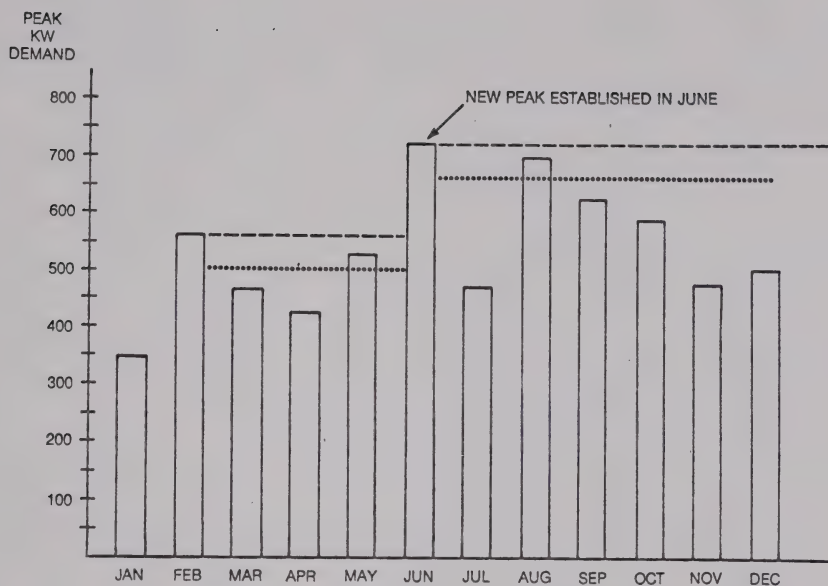
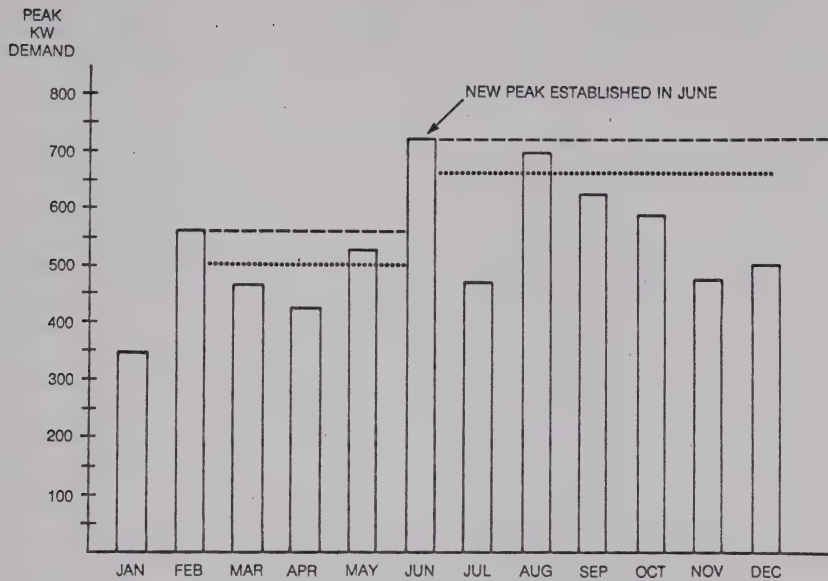


Figure 1.3: Demand Limit Control Application using Load Shedding to reduce demand



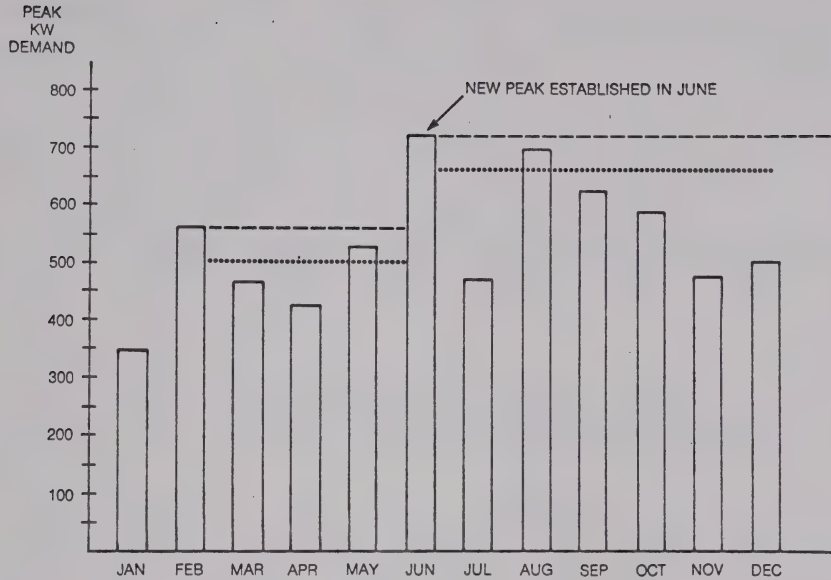
Dashed lines represent demand ratchet values. Minimum demand charge for following 11 months is calculated as a percentage of peak value. Dotted lines represent 90% of peak which becomes minimum billable demand value for following 11 months, or until a new higher peak is established. Premium paid by customer is difference between actual peak KW demand and dotted line.

Figure 1.6: Effect of Demand Ratchet on Demand Billing



Dashed lines represent demand ratchet values. Minimum demand charge for following 11 months is calculated as a percentage of peak value. Dotted lines represent 90% of peak which becomes minimum billable demand value for following 11 months, or until a new higher peak is established. Premium paid by customer is difference between actual peak KW demand and dotted line.

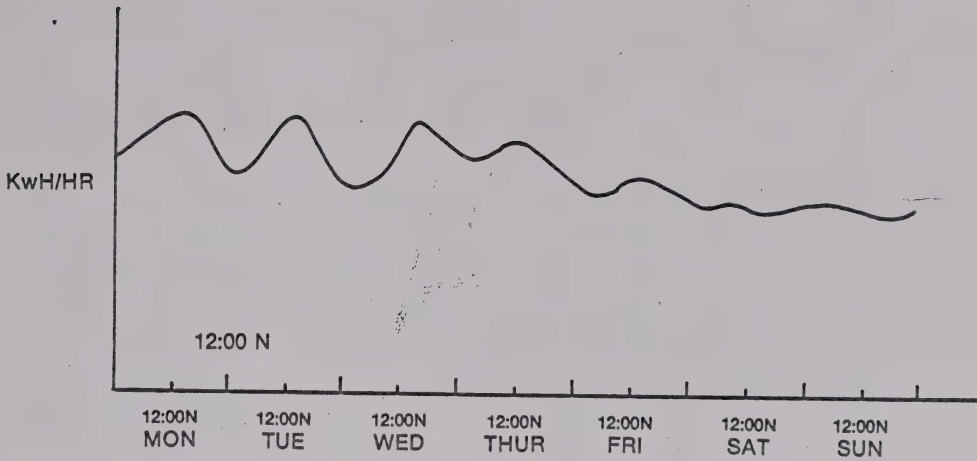
Figure 1.6: Effect of Demand Ratchet on Demand Billing



Dashed lines represent demand ratchet values. Minimum demand charge for following 11 months is calculated as a percentage of peak value. Dotted lines represent 90% of peak which becomes minimum billable demand value for following 11 months, or until a new higher peak is established. Premium paid by customer is difference between actual peak KW demand and dotted line.

Figure 1.6: Effect of Demand Ratchet on Demand Billing

CONSUMPTION RATE WITHOUT TIME OF DAY CONTROL



CONSUMPTION RATE WITH TIME OF DAY CONTROL

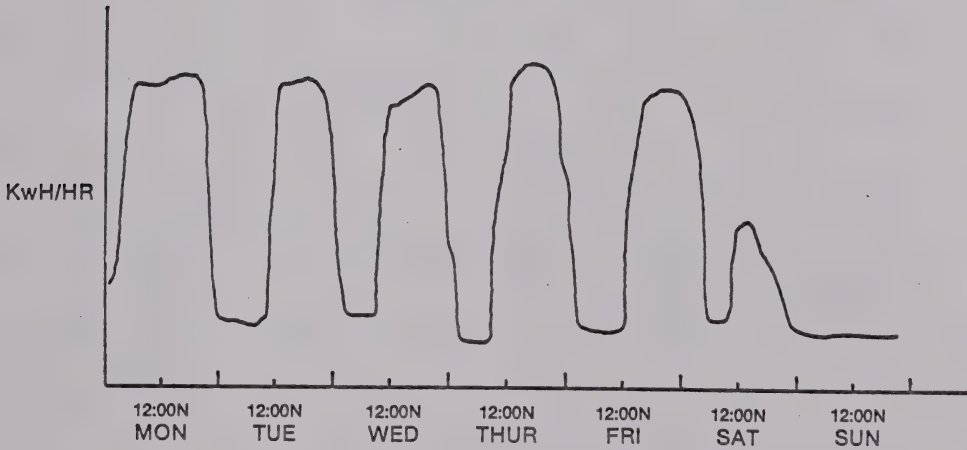


Figure 1.1

There are many factors that contribute to the load profile of a facility. The outdoor and indoor air temperatures are prime factors which contribute to the HVAC load.

With its unique Optimal Start capability, the Powersense 830 can constantly monitor changing environmental situations and make the appropriate adjustments. As an example, let us look at a situation where the outdoor temperature is 24 degrees F at 6 a.m., and the building requires 68 degree F indoor temperature by 8 a.m. when the first shift arrives. If the heating equipment is set back (turned off at closing time) and then switched on too soon in the morning, energy is wasted. If started too late, the employees complain of a cold building. With the Optimal Start control feature, the Trimax Powersense 830 continually senses both the outdoor and indoor temperatures. The unit will then turn on heating equipment based on preprogrammed data which tell it roughly how long it will take the heating equipment to overcome the effects of the temperature difference. The colder the indoor and outdoor temperatures, the earlier the heating equipment is switched on.

However, the Powersense 830 does not simply rely on the preprogrammed data. Rather, it monitors the temperatures and times required to achieve the desired temperature. If it finds the building is heated too quickly, it stores this new data and averages it with all existing data to determine a new start time.

The unit continues this self-adjusting mode until it arrives at optimum equipment starting time. All of this is possible because the Powersense 830 can interpolate the historical data. That is, if the unit has over time gathered sufficient data for 25 degree F and 45 degree F outdoor air temperatures, it will interpolate from that data to determine the proper load schedule when a 35 degree F temperature is encountered. Figure 1.4 illustrates the self-adjusting capabilities of the optimal start.

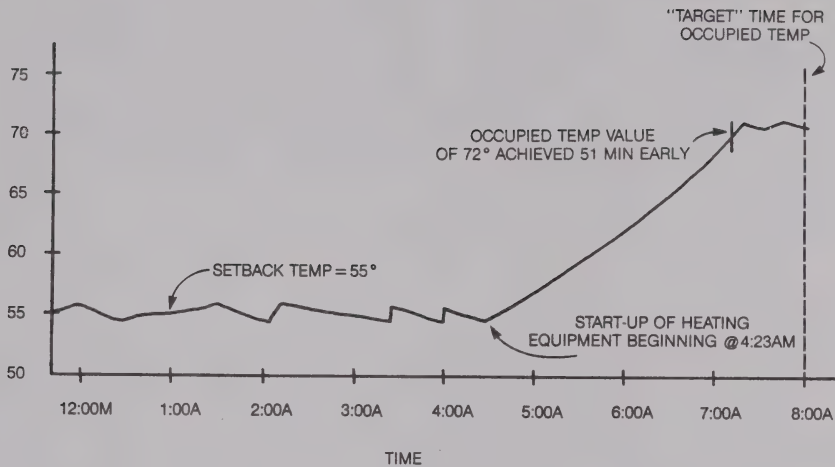
1.6 The Powersense 830 and Load Control

The Powersense 830 is a complete energy management system.

Perhaps the most innovative feature of the Powersense 830 is the sophisticated way in which it can monitor indoor and outdoor temperatures and perform self-tuning of its optimal start data base in order to maximize energy savings without sacrificing the comfort of building personnel.

1.7 History of Demand Charges

Utility demand charges have become a reality today, and it is the commercial and industrial users who pay the bulk of the rate.



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Figure 1.4: Powersense 830 Self Tuning Optimal Start Feature

Utilities, for a variety of reasons, are losing the battle against usage. To meet the demand that occurs during peak periods (summer and 12:00 noon - 6:00 p.m. on weekdays), the utilities have resorted to stop-gap measures to maintain capacity. Unable to build or afford new power plants in most situations, they are frequently forced to add an oil-fired turbine-generator to an already operational power plant. Regardless of the expense, the generator is in operation only a few hours a day. To recoup the cost of buying and operating these expensive generators, and to discourage peak usage, the concept of the demand charge was created.

Originally, utilities monitored usage in 15 minute intervals, four times an hour, 96 times a day. These were called fixed intervals. The highest usage rate reached during any interval in the month was used as the basis for the demand charge. That is, if a bakery switched on its electric ovens for 15 minutes a day to bake bread, it might create a demand of 5,000 KW. If that peak was reached only once that month, the demand charge would still be based on 5,000 KW.

Companies quickly found a way around the fixed interval. A company could split its peak use between two fixed intervals so that the utility saw a peak significantly less than 5,000 KW, as shown in Figure 1.5.

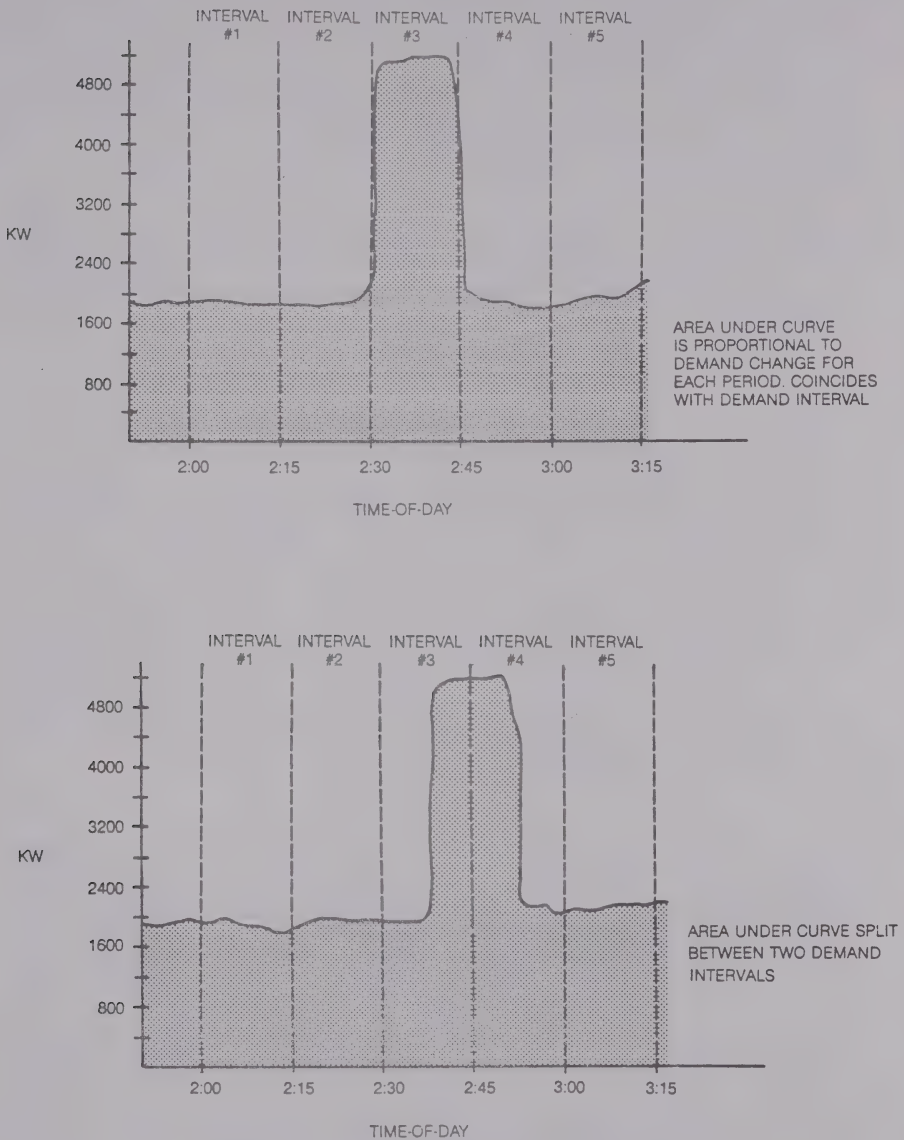


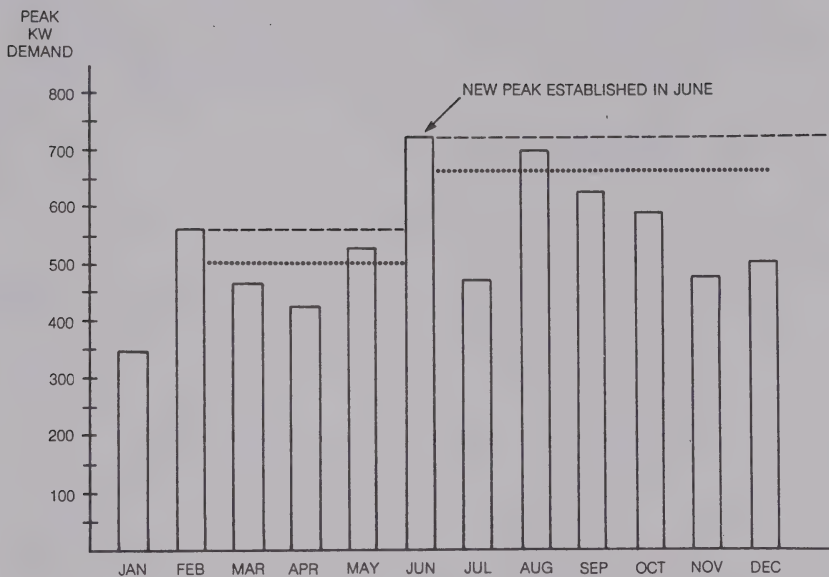
Figure 1.5: Peak Splitting to Reduce Demand with Fixed Interval

Not to be outdone, the utilities devised a new monitoring method called a sliding interval. Under this concept, the utility demand meter calculates a new 15 minute average use value every minute. This provides 1,440 demand averages per day.

More costly to the user is a new method of billing, used by many utilities, to determine demand charges, called a ratchet. The ratchet effect is shown in Figure 1.6.

Under the ratchet concept, the demand peak of the previous 11 month period, in this case 550 KW, provides the basis for the demand charge. The utility uses this peak value to levy a demand rate of 90%, as if the user had peak demand usage of 495 KW each and every month. Four months later, the user establishes a new peak demand of 700 KW. The utility now considers the new demand charge to be based upon 630 KW (90% of 700).

Notice that the peak usage drops in the third month. The demand charge remains based upon the previous 630 KW. Unless the peak figure is exceeded again, 630 KW remains the base charge for one year. The utility will generally use an 80-90% multiplier which will determine the demand charge portion of the bill each month. Once a high peak demand is registered, there is little incentive for reducing demand during the following 11 months.



Dashed lines represent demand ratchet values. Minimum demand charge for following 11 months is calculated as a percentage of peak value. Dotted lines represent 90% of peak which becomes minimum billable demand value for following 11 months, or until a new higher peak is established. Premium paid by customer is difference between actual peak KW demand and dotted line.

Figure 1.6: Effect of Demand Ratchet on Demand Billing

If the peak is exceeded in a given month, 710 KW in this example, the 12-month cycle is started all over again.

The method used to charge business and industry for peak use varies from utility to utility. The bottom line remains the same. A temporary loss of demand limit control can result in significant expense for up to 12 months.

To combat excessive demand charges and to nullify the ratchet-type long term charges, the Powersense 830 operates on its own sliding interval algorithm. It extrapolates the data points it receives to predict what the peak use will be in any given interval. Accurate predictions are very important for effective energy management. If the control unit were able only to recognize a peak period as it occurred, little, if anything, could be done effectively to reduce demand. Once the utility demand meter has read a new peak, it is too late for the user or the energy management system to take corrective action.

As shown in Figure 1.7, the Powersense 830 uses two stored values for comparison: the maximum allowed demand level (setpoint) and a deadband region.

These two points (along a time line) are the parameters and marginal area in which a load can be shed but not restored. The

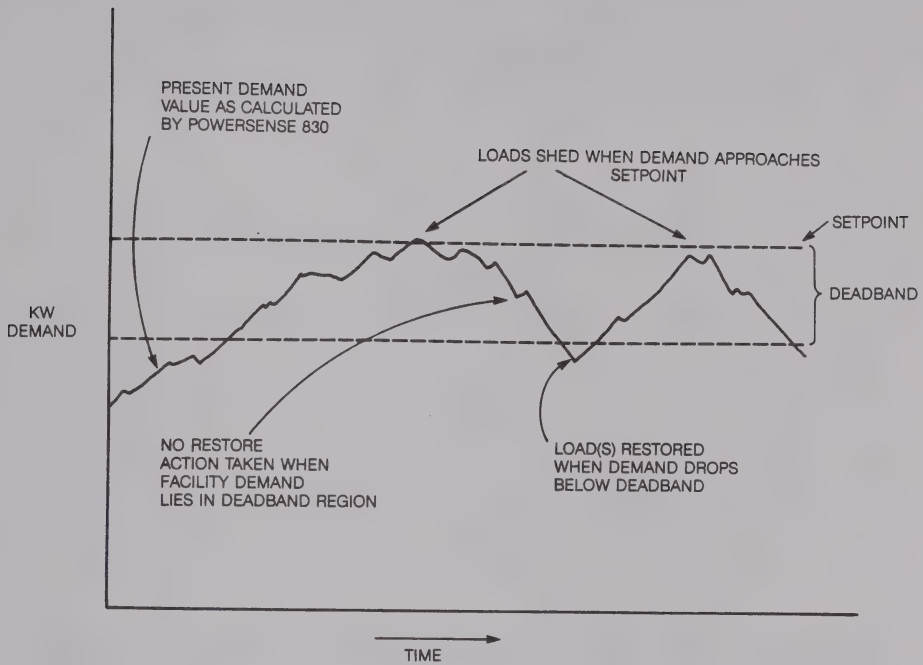


Figure 1.7: The Maximum Allowed Demand Level & Deadband Region

Powersense compares the real data received to a stored table of predicted demand values. If the comparison approaches the maximum level, loads are shed automatically. Afterwards, if the comparison drops below the deadband region, loads are switched back on. Thus the Powersense 830 cannot only prevent a facility from incurring high demand charges, but also from increasing the ratchet value.

1.8 Summary

Energy management is a vital concern to business and industry. It is a fact of life that energy costs will continue to increase for the foreseeable future and that utilities will continue to impose expensive rate structures that make conservation a necessity.

Successful energy management is possible today with sophisticated microprocessor controlled units such as the Powersense 830. Regardless of the utility rate structures, a Trimax unit can begin energy conservation immediately while providing significant savings on consumption and demand charges.

II. The Powersense 830 Basic System

2.1 Introduction

The Powersense 830 is a powerful microprocessor based energy management system that provides a level of control that until recently was only available in larger systems selling for thousands of dollars more. With the basic system (without options), the Model 830 has the capability for time-of-day scheduling, duty cycle control, two programmable holidays, and timer functions. All of these basic features can add up to substantial savings in utility costs.

Now add in the optional features: Demand Control, Multiple Setpoint, Timed Override, Temperature Input, Strip Chart Recorder, Serial Communications, and finally the Data Logging Option, and the Powersense 830 becomes one of the most advanced energy conservation tools available.

Trimax Controls, Inc. has available four models of the Powersense 830:

P/N 545-01: Powersense 830 with 8 circuits, expandable to 15 circuits in increments of one via additional Circuit Master Cards (P/N 482-03). All of the versions are capable of time-of-day scheduling, duty cycle control, and execution of 9 schedules per circuit per day.

P/N 640-01: Powersense 830 with 8 circuits and Expansion Panel. This model is expandable to 30 circuits in increments of one via additional Circuit Master Cards (P/N 482-03).

P/N 639-01: Powersense 830 with 8 circuits and Strip Chart Recorder. This unit is expandable to 15 Circuits in increments of one via additional Circuit Master Cards (P/N 482-03).

P/N 641-01: Powersense 830 with 8 circuits, Expansion Panel, and Strip Chart Recorder. This version is expandable to 30 circuits in increments of one via additional Circuit Master Cards (P/N 482-03).

2.1.1 Basic System Features

With any of the four models, the Powersense 830 comes equipped with the BASIC SYSTEM FEATURES. Later in this manual, we will examine each feature in detail. The following paragraphs will describe some of the characteristics of the Basic Model 830:

Time-of-day scheduling -- Each circuit can be scheduled and switched independently of all other circuits on a rotating seven-day schedule. Up to 9 ON/OFF time pairs (schedules) may be entered for each circuit for each day of the week. Additional eighth and ninth-day schedules can be programmed and retained for use on user designated holidays. These holidays are entered by date and may be retained in memory for years in advance. Up to 30 holiday dates can be entered, and up to 99 consecutive holidays can be designated for each date.

Duty Cycle Control -- Each of the 9 ON/OFF schedules may be assigned its own duty cycle pattern allowing up to 9 different duty cycle patterns per circuit. The Model 830 offers duty cycle ON/OFF values ranging from 1 minute to 12 hours and 59 minutes each in 1-minute increments, which results in over 600,000 possible unique duty cycle patterns.

Timer -- This function allows temporary extension of the normal ON time of any circuit(s) without altering any of the previously entered schedule data. The Timer feature is particularly useful for keeping certain loads ON after normal hours or for unplanned evening or weekend requirements.

Overrides -- Each Circuit Master Card is equipped with a manual override switch that allows any load to be forced ON or OFF, and removed from control of the microprocessor. The manual override switches will operate even if power is not available to the Powersense 830. Remote override ON/OFF inputs from external sensing devices (thermostats, photocell relays, and other contact closure sensors) can be connected to each Circuit Master Card. An example of this usage would be a thermostat input used to override duty cycle patterns of air conditioning equipment to full ON status should a particularly hot day occur.

Load Staging -- To prevent current surges, the Powersense 830 stages loads on sequentially in 15-second intervals whenever schedules call for more than one load to start at the same time.

Power Failure -- The Model 830 is equipped to maintain program memory for a period of five days during a total power failure. Upon restoration of power, loads are sequentially restored at 15-second intervals to their correct operating schedules, including those circuits on a programmed duty cycle pattern.

2.1.2 Optional Features

Trimax Controls, Inc, in developing the Powersense 830, took into consideration that each installation is unique. In this light, one of the main considerations was to design a flexible system; one that could be adapted to a variety of physical environments at a reasonable cost.

The basic system, as described in the preceding section, may be suitable for some users, but for facilities requiring more sophisticated control, the Powersense 830 offers a number of optional features. Through the appropriate choice of options, the Powersense 830 can reduce the demand (KW) component of utility bills from 15% to 25% and the energy (KWH) portion by 10% to 30%; frequently saving as much as 20% overall.

The following paragraphs review the optional features, each will be discussed in greater detail later in this manual:

Demand Control Option -- The user has a choice of either meter pulse contact input (P/N 492-03) or analog input from watt transducer (P/N 501-03) to achieve demand control. For facilities having multiple service entrances and/or multiple demand meters, the Model 830 may be fitted with up to 4 optional demand input

modules per system. Pulse and analog input modules may be mixed in the same unit.

This option allows the user to specify any averaging interval in the range of 0 to 60 minutes. A value of 0 entered for the interval specifies the system is to make control decisions based on instantaneous measurements of demand. A predicted demand value is constantly calculated and compared to the user entered setpoint value. Loads are shed when the predicted demand exceeds the setpoint.

Further, a flexible priority scheme allows loads to be shed and restored in a user prescribed order. Also, to eliminate constant user adjustments of setpoint, the Demand Control Option is equipped with an automatic setpoint adjustment feature which seeks the optimum demand setpoint value.

Multiple Setpoint Option (P/N 562-03) -- In some areas, demand charges vary on a time-of-day basis and the user may wish to automatically change setpoint values in order to take advantage of off-peak demand rates. This option provides a total of 5 setpoints, selected via remote switch closures or programmable for time-of-day selection. A sixth input also provides the ability to disable all demand control functions.

Strip Chart Recorder Option (P/N 581-03) -- This provides a running graph of the facility's demand. The information provided by the recorder can be used to monitor the overall efficiency of the facility (requires Demand Control Option, P/N 492-03 or 501-03).

Timed Override Option (P/N 593-03) -- Up to 8 user-designated groups of circuits can be overridden ON via remote switch closures for a user specified period of time. This is particularly useful for temporary lighting during hours of janitorial service.

Temperature Input Option (P/N 556-03) -- One or two temperature input modules, each capable of interfacing with 4 temperature sensors (P/N 738-39, indoor; P/N 739-39, outdoor), can be ordered with the Model 830. With this module in place, the Powersense 830 is capable of making control decisions based on inside/outside temperature values. This option allows for Optimal Start Control (the Fourth Option, see section 1.5 of this manual), Temperature Compensated Duty Cycle, and Temperature Compensated Demand Setpoint control.

Serial Communications Option (P/N 517-03) -- Using standard voice-grade telephone lines and an auto-answer modem (P/N 578-09), this option allows for total remote control of the Powersense 830. A teleprinter (P/N 579-09) can be added so that the user can enter, check, or change any parameters in the system. All front

panel operations, as described in this manual, can be conducted via the telecommunications link.

Data Logging Option (P/N 691-03) -- By adding additional system memory, this allows a Model 830 equipped with the Serial Communications Option to collect and retain a record of facility energy usage along with temperature histories.

2.2 Inspection and Storage

The Powersense 830 has been completely tested and inspected at the factory prior to shipment.

After receiving the unit, check the outside of the shipping container for signs of damage. While unpacking, make special note of how the unit was packed by the factory. If the unit needs to be returned to the factory, it should be repacked exactly as received from Trimax.

Do not throw away the shipping container after unpacking the 830.

After the Powersense 830 is removed from the container, visually inspect the external and internal parts of the unit for components that may have been cracked or broken during shipment, or hardware and connectors that may have been shaken loose.

If damage is detected, retain the original packing materials and receipts. All damage claims should be filed promptly with the transportation company. Also, notify the Trimax factory of any claim, so that repairs and replacements can be arranged quickly.

As described in section 2.1 of this manual, the Powersense 830 is available in four different models. Figure 2.1 shows the Model 830 fully equipped with Expansion Panel and Strip Chart Recorder Options. If you have not received the proper unit, contact your distributor or the Trimax factory immediately.

Other items pertinent to the installation and operation of the Model 830 are included in the container.

All input and output cards are packed separately. There will be at least eight output cards, labeled Circuit Master Card, for each model. Depending on your order, there may be up to 30 Circuit Master Cards and as many as 11 optional input cards.

The cards should be visually inspected for cracks and loose or damaged components. Follow the procedures mentioned previously for damage and replacement claims.

Finally, the keys to unlock, open and operate the unit are packaged in a separate plastic accessory bag. If the keys are missing,, contact your distributor or Trimax Field Service Department.

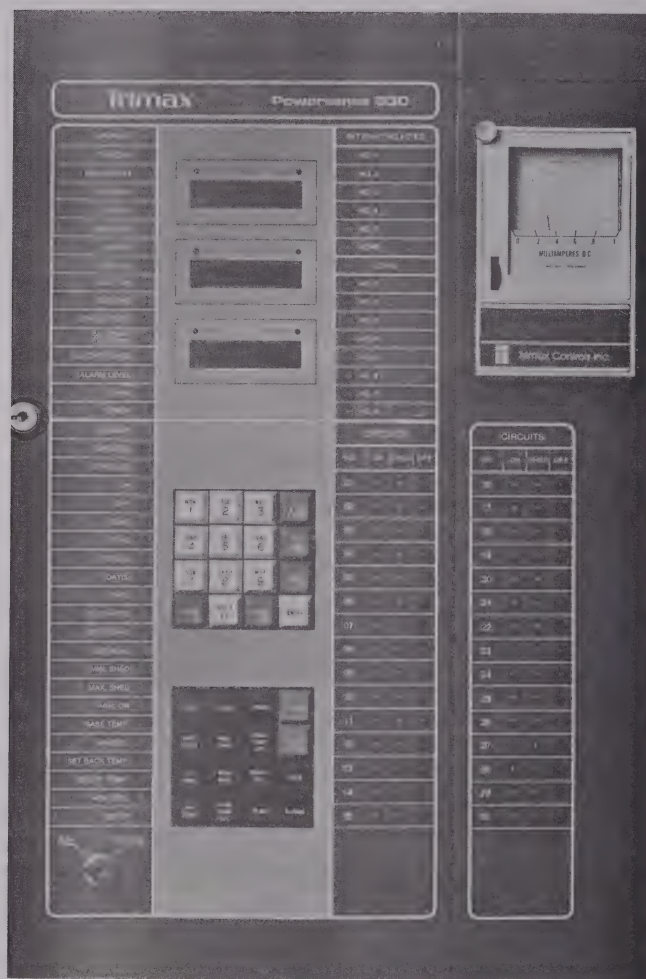


Figure 2.1: Powersense 830 with Expansion
& Strip Chart Recorder Panel

If the Model 830 must be stored for any length of time, it should remain packed in its original shipping container. The unit must be placed in a dry location with an ambient temperature between 0° - 130° F (-18° -- 55°C).

2.3 Location

The Powersense 830 is designed for indoor use only. In colder climate areas, the unit must be located in a heated environment that remains above 32°F (0°C) at all times. A location should be selected where the ambient temperature is compatible with the Powersense 830 operating range of 32° - 122° F (0° - 50°C), and is protected from the extremes of weather, wind, humidity, dust, direct sunlight, or other adverse conditions.

The 830 is designed for surface mounting only. It should be mounted on a vertical surface or wall with the center display window located at eye level for a person of average height. Do not attempt to recess the unit into the wall. Mount the 830 in a location which provides at least 7" (18cm) of unrestricted wall space along the right side of the unit so that the front case assembly can be opened freely to provide access to internal wiring connections.

When selecting a wall area, follow these important criteria: 1) The wall must be sturdy and free from any vibration; 2) the wall must be free of any heat producing equipment and devices, e.g., transformers, baseboard heaters, heating ducts or registers. These heating units may cause internal heat dissipation problems within the Powersense 830. 3) Avoid bulky equipment or objects below the unit or on the floor which will interfere with user access.

CAUTION

Do not install the Powersense 830 in a location where oil, acidic fumes or other corrosive elements may damage the paint or internal components.

CAUTION

Do not install the Powersense 830 near large contactors, motors, transformers, switchgear, or any heavy machinery which may cause electrical interference.

Figure 2.2 shows the Powersense 830 mounted in a suitable location.



Figure 2.2: Powersense 830 Installed

2.4 Basic Requirements

Installation of the Powersense 830 should be performed by a qualified Trimax Dealer with a sound working knowledge of HVAC control systems. The installer should read and completely understand the "Trimax Dealer Handbook," Bulletin 9-2. This publication provides engineering and application information relevant to the installation of the Powersense 830.

The installer must make the arrangements for all external relays, transformers, contactors, wire, conduit, panels, etc., before beginning the mounting and wiring of the Model 830. The particular requirements for the installation of each unit will vary depending upon the facility to be controlled. Drawings of the complete system design should be on site at the start of installation. This manual covers only the actual mounting and connection of external wiring to the Model 830.

The Powersense 830 unit is shipped ready for wall mounting. The following items make the task easier and provide flexibility for mounting other equipment:

Flywood (optional) -- 3x4 foot, A.C. grade or better, 3/4" to 1.0" thick (1 inch preferred).

Four 1/4" carriage bolts -- length depends upon plywood thickness: 1-1/4" length for 3/4"; 1-1/2" length for 1" plywood.

Four 5/16" lag bolts -- 4 inch length (minimum).

Eight 1" flat washers and four 7/16" (maximum) nuts -- for carriage bolt and lag bolt assembly.

These materials should be sufficient for mounting the Powersense 830.

2.5 Mounting the Powersense 830

The easiest and most flexible method of mounting the Powersense 830 is to attach the unit to a sheet of plywood (see Basic Requirements), and then mount the plywood to the wall. It is recommended that you size the plywood to accommodate auxiliary equipment, such as a relay panel, modem, pull box, or junction box. A section 4' (1.2M) wide x 3' (1.0M) high should be sufficient.

Cut, sand, prime, and paint the plywood before attaching the 830.



Make sure there is at least 7" (18cm) of free space along the right side of the unit to allow the front case assembly to be opened freely for access to internal wiring connections.

To mount the unit, perform the following sequence of operations:

1) Lay the unit face up on a sufficiently large, flat work area. Unlock the front door of the unit with the appropriate key supplied in the plastic accessory bag. Swing the door open. Locate the three screws along the left side of the unit, just inside the door. These screws, along with two hinges and 3 (or 4) ribbon cables attach the front case assembly to the unit. Remove the screws, then close and lock the front door.

2) Grasp the case in the center of the left side of the unit and carefully swing the entire front case assembly up and to the right as shown in Figure 2.3. As you do so, look on the inside of the unit to locate the ribbon cables. Without forcing the cables loose, rest the front case assembly on its right side as shown in Figure 2.4. Depending upon your unit, three or four

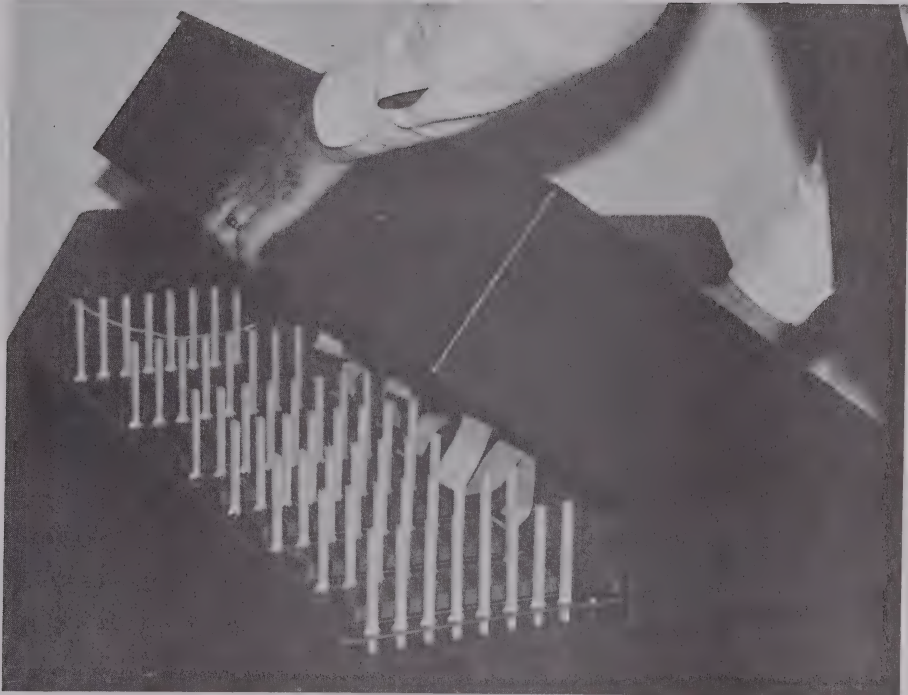


**Figure 2.3: Mounting the Powersense 830-Swinging
Front Case Assembly**

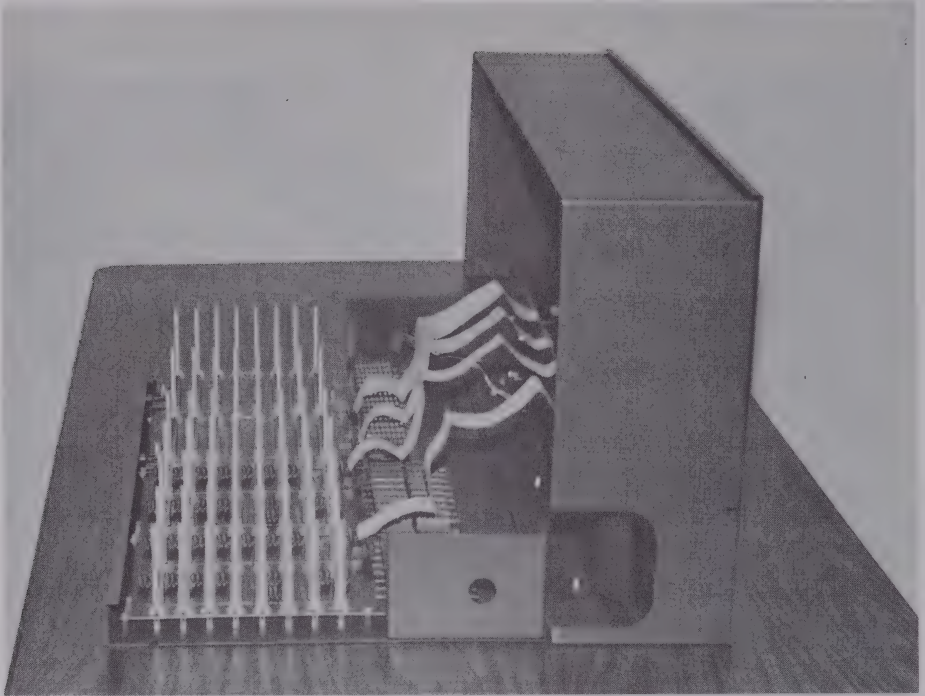


Figure 2.4: Front Case Assembly Resting on its Right Side

ribbon cables connect the front door to the interconnect printed circuit cards. At the point of connection, remove the cables by grasping the plastic portion of the connector at each end between your thumb and forefinger and gently rocking the connector back and forth while pulling firmly. DO NOT PULL ON THE CABLE ITSELF.

3) There are two hinges along the right side of the unit which secure the front case assembly to the rear mounting plate. Remove the four acorn nuts, two on each hinge. Lift the entire front case assembly, removing it from the rest of the unit, and place it in a safe place until all connections of control and sensor wiring are completed.

4) Mount the rear wall mounting plate assembly on the plywood using four carriage bolts 1/4" in diameter. Select a bolt length that is consistent with the plywood thickness (1-1/4" for 3/4" thick plywood, 1-1/2" for 1" plywood). Insert the bolts through the plywood so that the head of the bolt is on the back (wall) side of the plywood. Fasten the Model 830 mounting panel to the plywood surface with 1/4" - 7/16" nuts. Nuts of this size will fit through the lower

portion of the mounting holes so that they will only need to be loosened, not removed, to allow the unit to be lifted off the wall.

 WARNING ★

Do not drill holes in any portion of the Powersense 830. Metal shavings from the drilling operation can cause short circuits within the unit. Use the existing knockouts and mounting holes. Existing holes may be enlarged by using a suitable chassis punch that does not produce metal chips or shavings.

 WARNING ★

Drilling holes in any portion of the unit will void the Powersense 830 warranty.

5) Mount the plywood containing the Powersense 830 wall mounting plate assembly to the wall using four lag bolts which are at least 4" in length and 5/16" diameter. A 1/4" pilot hole is suggested. Be sure

that the lag bolts are firmly secured to the 2 x 4 vertical studs inside the wall. Use 1" flat washers between the head of the lag bolt and the plywood.

In most areas, local electrical codes do not require low voltage control wiring to be run in conduit. However, it is recommended that you run conduit between the unit and any adjacent panels and/or from the unit to the ceiling and floor. This way, exposed wires will not be visible and the installation will have a much neater appearance.

6) For ease of installation, route all sensor (input) wiring into the unit through the top conduit connection, since these wires are connected to sensor input terminals in the top half of the wiring panel. Run control (output) wiring through the bottom conduit connection as this wiring will be connected to the output relay terminals in the lower half of the wiring panel. Figure 2.5 illustrates the input/output wiring of the Model 830.

 Note

If the holes in the unit are not large enough for the conduit you are using, enlarge the holes using a metal

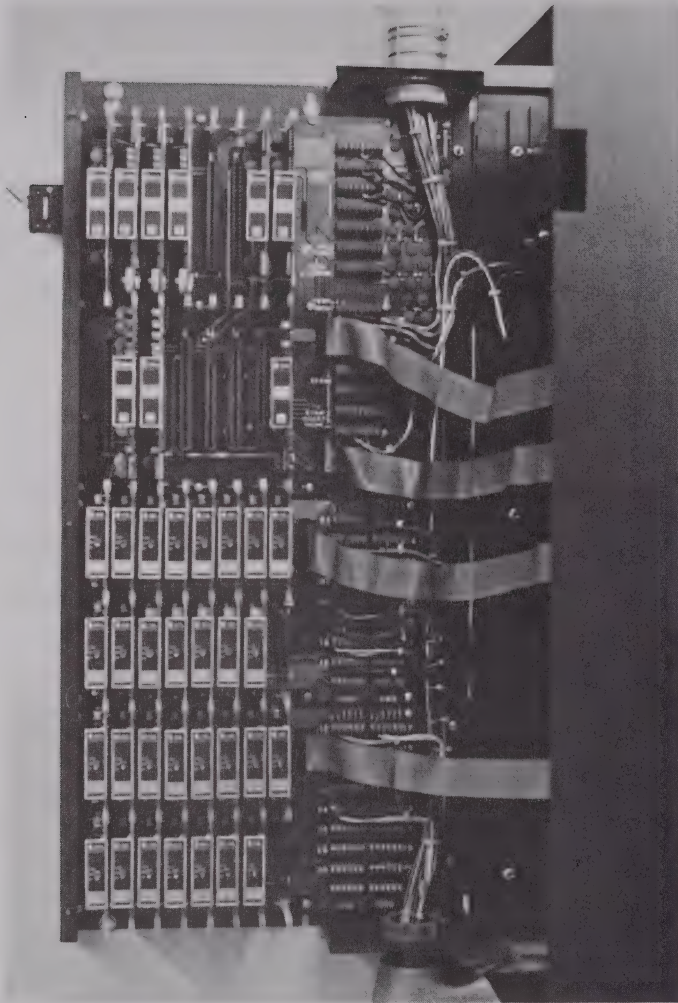


Figure 2.5: Correct Routing of Input and Output Wiring

punch only. Do not use a saw, nibbler, drill, or reamer to enlarge the holes.

 Note

Once conduit is run above the ceiling, it can be terminated and individual wires can be run to sensing devices or remote relays if allowed by local codes. However, when securing the conduit terminations to and from the unit, make sure there are no rough edges that could cut wiring insulation when the wire is pulled through the conduit.

It is recommended that you complete the sensor and control wiring before the front case assembly is replaced and power is applied to the Powersense 830. See the appropriate chapter(s) of this manual for specific instructions and diagrams on connection of sensor wiring.

2.6 Wiring Output Relay Connections

The Powersense 830 provides for the control of external circuits

by using internal Class 2 low voltage Form C control relays (24 VAC) having normally open/normally closed contacts (SPDT).

WARNING ★

Use of the Powersense 830 in applications employing other than Class 2 service for control relay switching will void the warranty.

Begin installation of the Model 830 by wiring the output relay (load) connections. These connections correspond to the Circuit Master Cards for which there are 15 card connection sockets in the middle of the unit, as shown in Figure 2.6. The Expansion Panel, if installed, provides card connections for an additional 15 circuits in the lower portion of the 830.

Also shown in Figure 2.6 are the terminal blocks for each circuit. The blocks are arranged in two columns with six possible connections for each. They are numbered to correspond with the appropriate Circuit Master Card. The left column corresponds to the odd-numbered circuits and the right column to the even-numbered circuits. This matrix feature is useful as an aid in planning the installation for circuit and wiring diagram identification, especially when Remote ON, Remote OFF, and Remote Load Sense features are used extensively.

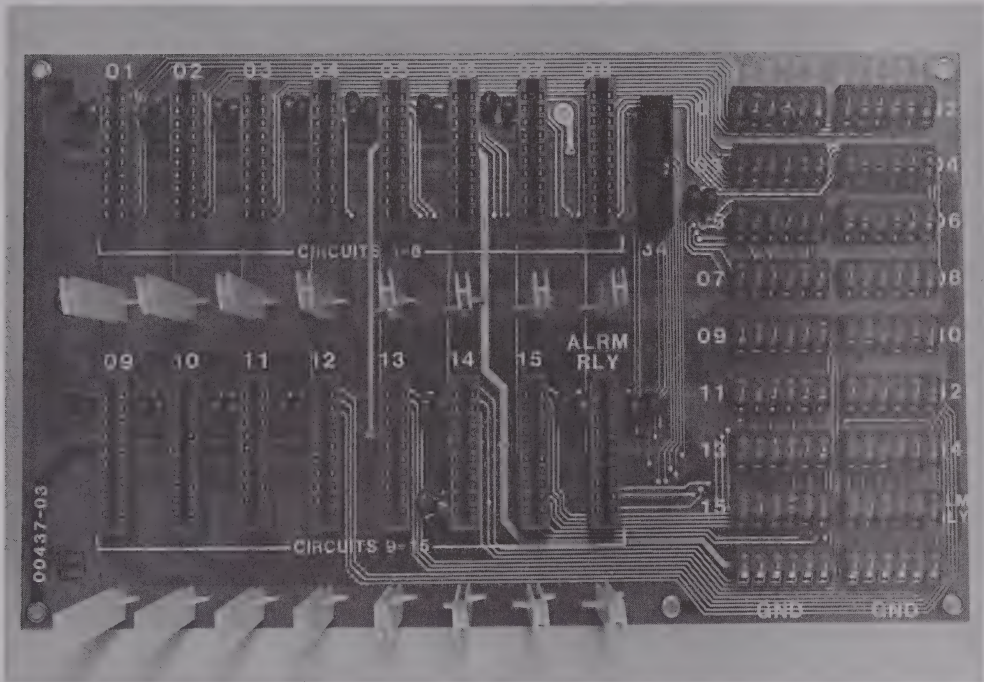


Figure 2.6: Circuit Master Card Slots and Terminal Blocks

The one exception to this arrangement is the terminal block immediately to the right of terminal block 15. The basic Powersense 830 includes eight Circuit Master Cards and card connections for an additional seven. The last position on the right side of the last terminal block cannot be used as a standard control circuit (i.e., for circuit number 16). This block is dedicated to an Alarm Relay Card, which provides a relay closure in conjunction with front panel alarm lights. The Alarm Relay Card is a standard Circuit Master Card that provides a contact closure only during an alarm condition as indicated on the Powersense 830 front panel.

If your unit includes the Expansion Panel, which provides for up to 15 additional Circuit Master Cards, the card connections and corresponding terminal blocks are located in the lower section of the unit. Note, however, that the terminal block for circuit 16 is located in the upper left column of the lower section and that the even-numbered circuits are now in the left column and the odd-numbered circuits in the right column. As with circuits 01-15, the last card slot and the terminal block to the right of circuit 30 cannot be used for an additional circuit of control. At the present time this slot and terminal block have no assigned function.

Figure 2.7 shows a close-up of a terminal block with the six available connections for each Circuit Master Card.

<u>TERMINAL</u>	<u>FUNCTION</u>	<u>DESCRIPTION</u>
1	N/O	Normally Open Contact of Control Relay on Circuit Master Card
2	N/C	Normally Closed Contact of Control Relay on Circuit Master Card
3	COM	Common of Control Relay on Circuit Master Card
4	R-SEN	Remote Load Sense Input
5	R-ON	Remote Override ON Input
6	R-OFF	Remote Override OFF Input

These six connections correspond to the numbered screw connections on each terminal block.

The Normally Open and Normally Closed designations on the terminal blocks indicate the status of the Trimax control relay on the Circuit Master Card when the 830 has no power applied to the input terminals.

When the N/O contact of the control relay is used, the 830 acts to close the contacts and thereby completes the circuit. When the N/C contact of the control relay is used, the contacts are opened and the Model 830 interrupts the external circuit. The N/O and N/C designations on the terminal blocks apply to the configuration of internal relays when the 830 has no system power applied.

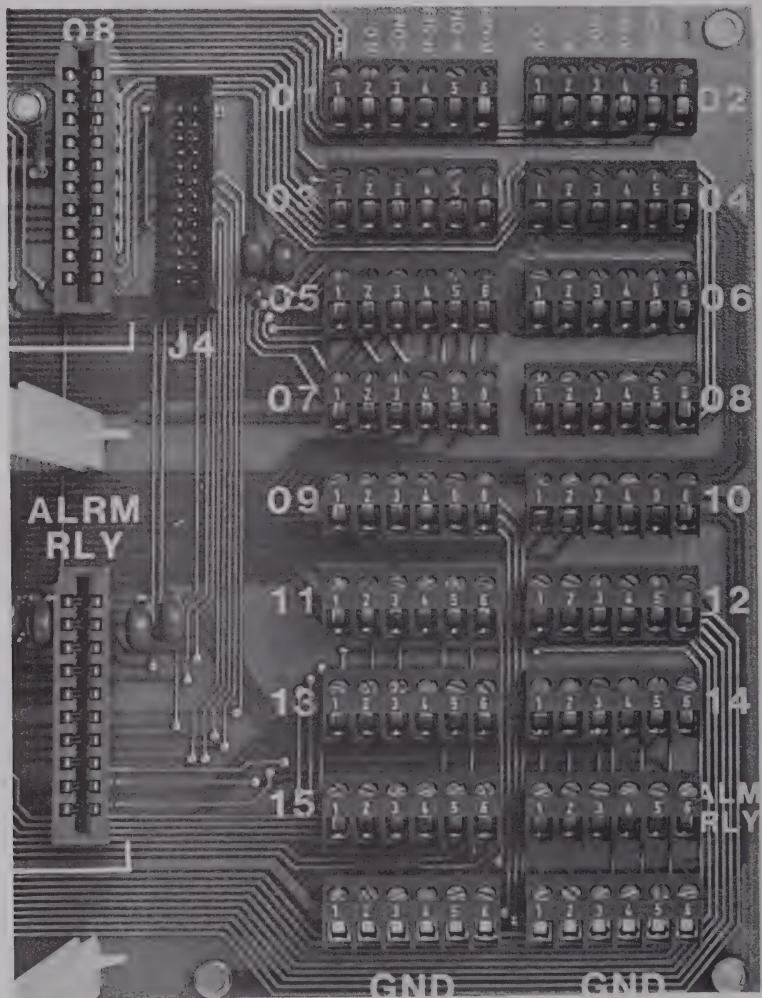


Figure 2.7: Output Terminal Blocks with Six Connectors

 Note

The N/O and N/C designations on the terminal blocks should not be construed as labeling for the type of remote relay that is to be connected to the terminal block. There are situations where normally closed remote relays may be connected to the normally open contact of the Powersense 830 and vice-versa.

For efficient use of the unit, you may connect several remote control relays to the same 830 output relay if they share a common external power source, so long as the 2 ampere rating of the control relay is not exceeded.

The Remote Load Sense feature of the Model 830 allows a confirming switch closure from the controlled load to be run back to the unit. The 830 will then sound an audible alarm if the switch closure does not "track" the operation (both on and off) of the circuit within 30 seconds of switching the load ON or OFF. The alarm will sound and the appropriate ON or OFF status indicator for the circuit will flash as long as the conflict exists.



Note

Verify that the loads connected to the 830 output relays do not exceed the individual current rating (2 amps at 24 VAC) for each control circuit relay.

If a group of external control relays require the same control strategy but do not or cannot share a common power source, additional multiple-pole relays should be used to isolate the individual control circuits, so that they may be connected to one Powersense 830 circuit.

A Circuit Master Card configured for fail-off operation applies voltage to its relay coil when the card is commanded ON by the Powersense 830. Loss of power to the 830 causes each relay to return to its rest state, and the load will assume the OFF condition.

A Circuit Master Card configured for fail-on operation applies voltage to its relay coil when the card is commanded OFF by the 830. Loss of power to the unit again allows the relay to return to the rest position. This time, however, the load assumes the ON status since the relay is in its rest state whenever the load should be ON.

If true fail-on (or fail-safe) operation is desired regardless of the type of failure, the load should be connected to a Circuit Master Card configured for fail-on operation. Use a remote relay with N/C type contacts to control the load. Any failure of the 830, its power source, the control relay in the 830, or the 24VAC relay power, results in switching the load ON. The load will stay ON until the problem is corrected by facility personnel.

Before the Circuit Master Cards can be installed in the unit, the 5 rocker switches in the center of the cards must be set. (If you have ordered Pulse Circuit Master Cards, P/N 740-03, there will be no rocker switches.) The standard maintained contact type of Circuit Master Card, P/N 482-03, exists in three versions - Revision A, Revision B, and Revision C. The Revision A card is no longer shipped with new units, so you most likely have Revision B or later.

 Note

THE SETTING OF THE ROCKER SWITCHES DIFFERS BETWEEN THE VARIOUS REVISION OF THE CIRCUIT MASTER CARD. Before setting the rocker switches on any of your Circuit Master Cards, it is important to determine which version card you have.

The A and B revisions of the cards each have 5 rocker switches in the center of the card. Figure 2.7.1 shows a Revision B Circuit Master Card. The Revision C Circuit Master Card (Figure 2.7.2) has only 4 slide switches on the switch block in the center of the card and is easily distinguishable from the A and B revisions. If need be, to determine the revision level of the card(s), locate the assembly number which is stamped on the extreme edge of the card near one end of the fuse. The number will read either 00482-03A, 00482-03B, or 00482-03C. The last character of the assembly number specifies which revision of the card you have. If you have a D or E Revision, treat it as though it is a Revision C.

For Revisions A and B, set the rocker switches as illustrated in the table in Figure 2.8. If the Circuit Master Card is a Revision C, set the slide switches and the position of the blue jumper, which is located next to switch number 1, according to the table in Figure 2.8.1.

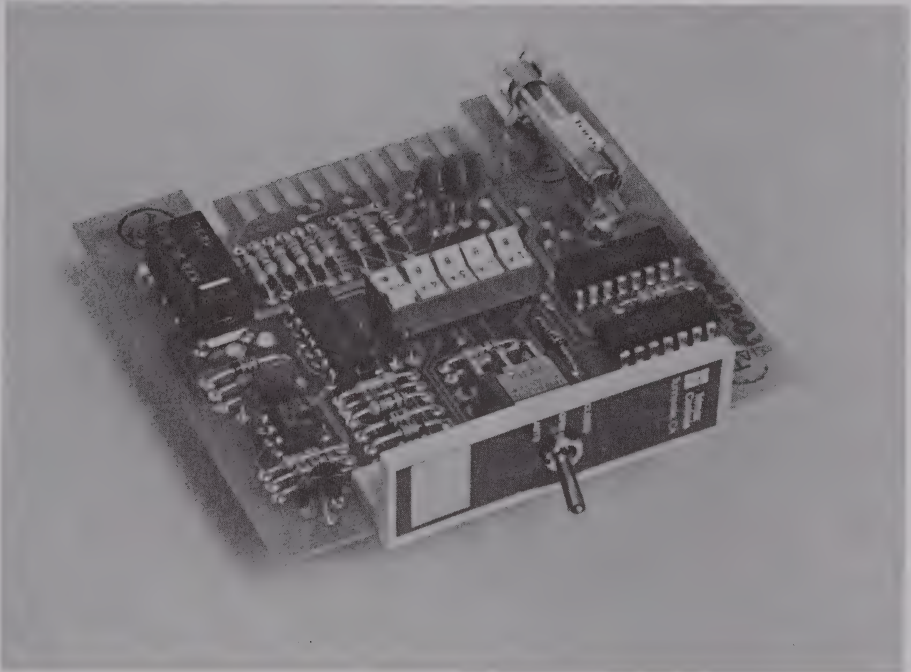


Figure 2.7.1: Revision B Circuit Master Card

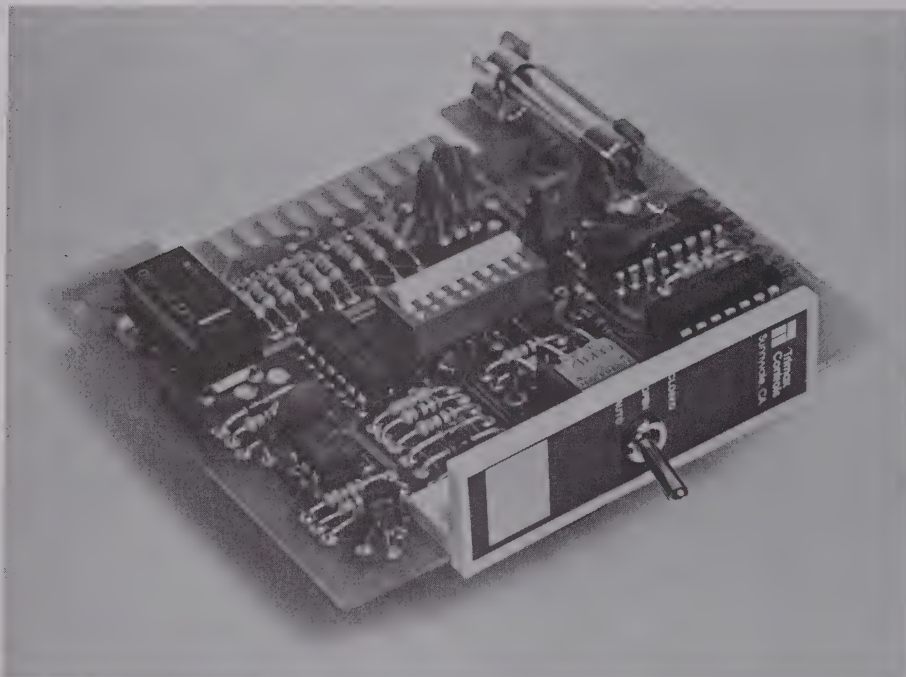


Figure 2.7.2: Revision C Circuit Master Card

Switch No.	Rev. A	Rev. E
1	Press the "A" side if the external relay is wired to the COM and NO terminals of the 830. Press "B" side if wired to COM and NC terminals.	Same as Rev. A.
2	Set the same as switches 3 and 4.	Press on the "A" side if the load switches ON when the manual override switch is set to the OPEN position. Press on the "B" side if the load is OFF when the switch is set to the OPEN position.
3&4	Press both switches on the "A" side if fail-off operation is desired for the card. Press on the "B" side for Fail-on operation.	Press both switches on the "A" side if fail-on operation is desired for the card. Press on the "B" side for Fail-off operation.
5	Press on the "B" side if The Remote Load Sense is to be used and a confirming switch closure is connected to the R-SEN connection. Press "A" if no confirming switch closure is connected.	Same as Rev. A.

Figure 2.8: Circuit Master Card Rocker Switch Settings

Switch No.	Rev. C
Blue Jumper	Place across the 2 pins closest to switch block if external relay is wired to Normally Open terminals of the 830. Place across 2 pins furthest from switch block if external relay is wired to Normally Closed terminals of the 830.
1	Slide towards number 1 if load switches ON when CLOSED/OPEN/AUTO switch is set to OPEN position. Slide away from number if load is to switch OFF when CLOSED/OPEN/AUTO switch is set to OPEN.
2&3	Slide both switches toward number if Fail-ON operation is desired. Slide both switches away from numbers if Fail-OFF operation is desired.
4	Slide away from number 4 if the Remote Load Sense feature is to be used and a confirming switch closure is connected to the R-SEN connection. Slide towards the number if, and only if, no confirming switch closure is connected.

Figure 2.8.1: Revision C Circuit Master Card Switch Settings

Next, check to see that each Circuit Master Card has a good 2 amp Slo-Blo type fuse installed. Then insert the cards. All Circuit Master Cards are interchangeable. It is recommended that you install the cards sequentially, e.g., Circuit 01 in slot #1, Circuit 02 in slot #2, etc., up to Circuit 15 (Circuit 30 if you have an Expansion Panel). Each card has an edge connector on one end and a three position toggle switch on the other. The edge connector is to be inserted into the card connection for each socket.

 WARNING ★

Do not install Circuit Master Cards in an upside-down position. Doing so will damage the card and subsequent repair is not covered by the Trimax warranty.

 CAUTION

If it is necessary to replace a fuse on the Circuit Master Card, do not use a fuse with a rating that exceeds 2 amps. The traces on the printed circuit

board are designed to carry a maximum of 2 amps at 24V. The traces will melt if a larger fuse is installed and current in excess of 2 amps is applied. If the circuit continues to blow the 2 amp fuse, use an interposing relay to reduce the current burden on the Model 830 control relay.

 WARNING *

THE POWERSENSE 830 WARRANTY DOES NOT COVER TRACES THAT HAVE BEEN BURNED OR MELTED FOR ANY REASON.

 WARNING *

Do not, under any condition or circumstances, apply more than 24 VAC to the output relay connection. The Model 830 is designed for low voltage Class 2 operation and is not adequately insulated, shielded, or labeled for voltages above 24 VAC. Potentially dangerous situations could be created by direct connection of higher voltages.

 CAUTION

Circuit Master Cards can be removed without removing the nylon card guides. The card guides should never be removed. Removal is difficult and can cause damage to the relay interconnect printed circuit board.

The wiring procedure for each Circuit Master Card is identical. In general, strip off 1/4" of insulation from each load relay lead. To wire the relay to the terminal block connection, loosen the set screw with a 1/8" flat blade screwdriver. Guide the exposed section of the lead into the connection hole. Tighten the screw. Do not strip more than 1/4" from the lead to prevent exposed wiring appearing above the terminal block. Ensure that the screw is not clamped into any portion of the insulation as electrical contact may not be made.

Connect power from one leg of the 24VAC relay transformer (not the 100VA transformer supplied with the unit) to the terminal labeled CCM as shown in Figure 2.9. Then connect the load relay to either N/O or N/C, depending upon the logic of the remote relay and whether the Circuit Master Card is configured for fail-on (fail-safe) or fail-off operation.

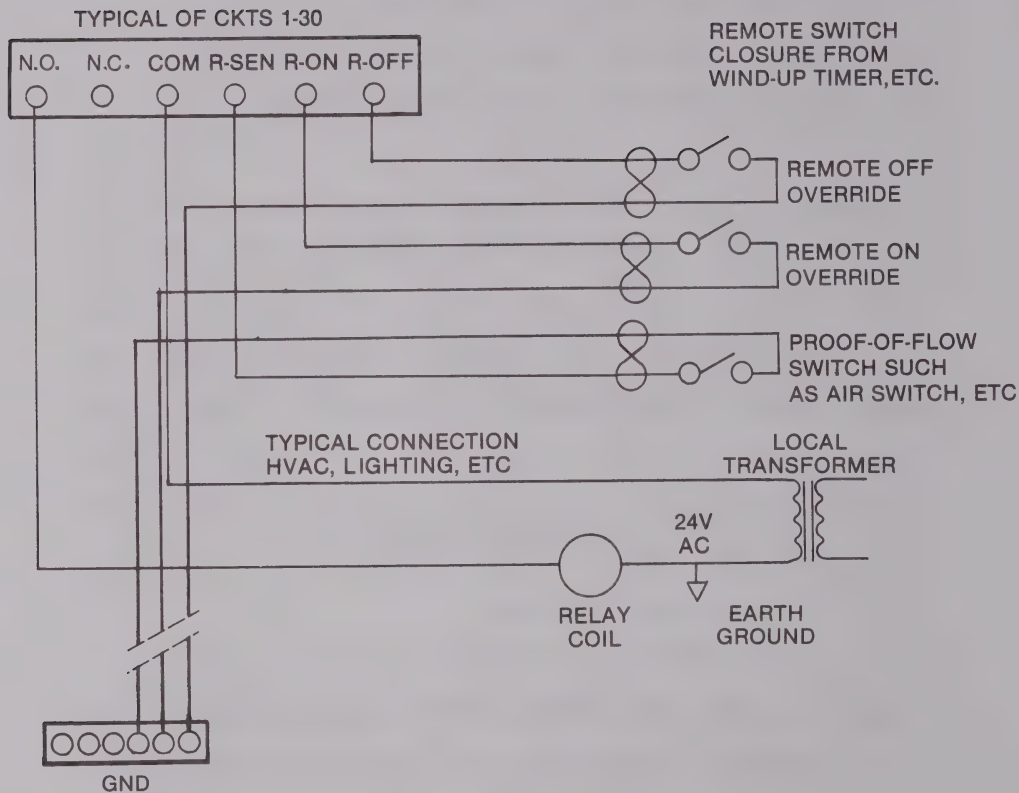


Figure 2.9: Wiring Output Relay (load) Connections

 Note

The Model 830 must not be used as a junction box or pull box. There is insufficient room inside the unit for any excess wire; all wiring should be neatly dressed and run out of the unit with the minimum possible amount of wire remaining inside the unit.

 Note

Use only 18 gauge wire, either solid or stranded. A larger wire size is unnecessary and more difficult to work with in the confined wiring area of the unit. Individual wires are also easier to handle and to route over other terminal blocks. When multiconductor cable is used for control wiring, it is suggested that the outer cover jacket be completely cut back to the conduit entrance to allow individual wires to reach the terminals.

To use the Remote Override for any circuit, route the wiring through suitable, normally open switching contacts (i.e., thermostat, wind-up timer, photocell). Return it to the REMOTE SIGNAL GROUNDS in the lower right-hand corner of the circuit interconnect card.



To avoid any possible short circuit or ground loop problems, do not terminate any external 24 VAC power source common return at the remote signal ground.

The override feature may be used either singularly or in multiples; ON's can be bussed with OFF's if you desire. This way, a single remote sensor switch can override a circuit ON while simultaneously overriding another circuit OFF.

The remote overrides are self-powered and require only a switch closure to operate. The switch closure has the same effect as moving the manual override Circuit Master Card switch from its normal AUTO position to either OPEN or CLOSED. However, remote overrides require that the 830 have system power, while manual override switches will operate the load even if system power is removed. The 830 front panel lights will identify circuits overridden by either the manual override switch, or by the remote override device wired as described above. If the override device is wired in parallel or series with the control relay contacts, the front panel may indicate an incorrect status for the overridden circuit.

The Remote Load Sense connection allows the 830 to verify that a load has responded properly to control action. To verify proof of flow for any circuit, route a wire through an appropriate sensing device (i.e., pressure switch or sail switch) and connect the leads to the REMOTE SIGNAL GROUNDS and the R-SEN (#4) connection on the terminal block.

 Note

If a confirming switch closure is brought back to the 830 for load verification, the remote load sense feature must be enabled on the Circuit Master Card. If a switch closure is provided (and contact is made) with the feature disabled, the unit will act as though there is no Circuit Master Card installed for that circuit.

2.7 Input/Sensor Connections

The Powersense 830 is available with a variety of user installable options. The basic unit, however, has no plug-in cards other than Circuit Master Cards and does not require wiring beyond power and load control as previously described. Units ordered with a strip chart recorder will have a plug-in card labeled "STRIP CHART RECORDER" (see the appropriate chapter of this manual dealing with that option). The optional cards provide additional control and do require wiring to the terminal blocks. Locate the card slots and adjacent blocks (labeled "A" through "P") in the upper left side of the Model 830, as illustrated in figure 2.10. For each slot there is a corresponding terminal block for connection of sensors.

Unlike the Circuit Master Card connections, each of these slots is dedicated to a specific function. This section reviews the use of each option slot, but will not go into detailed installation instructions.

Slot A is a standard RS232 port for use by the Serial Communications Card when utilizing the Serial Communications

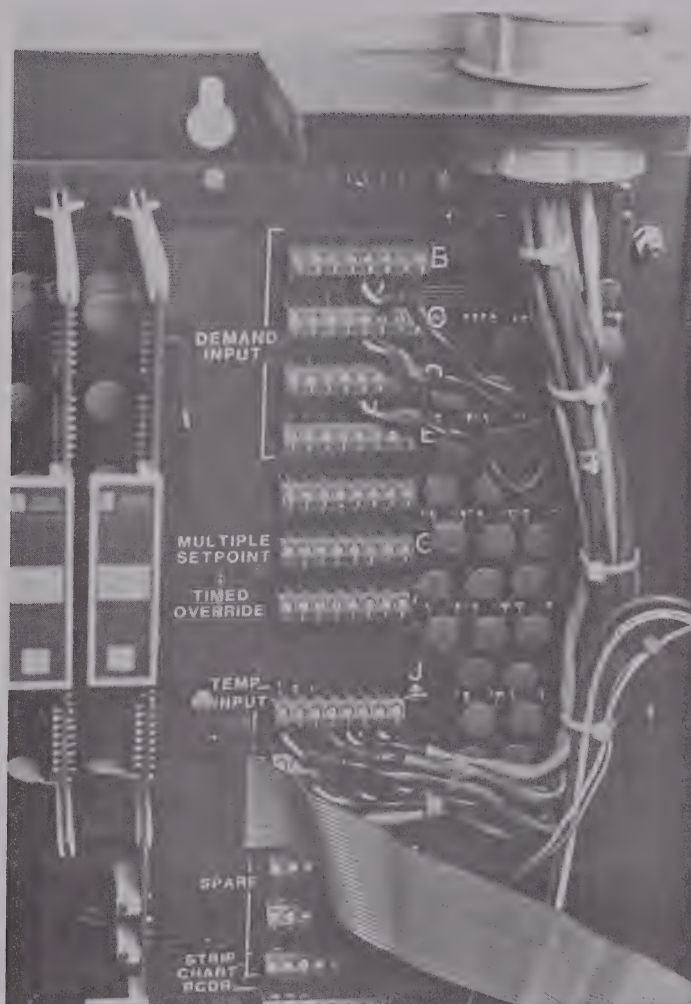


Figure 2.10: Sensor Input Connections

option for interface with a modem and standard voice-grade telephone lines. The port is located in the upper left hand corner of the Powersense 830.

Slots B through E are dedicated to the Demand Input Cards. The unit can accommodate up to 4 Demand Input Cards of either pulse or analog type.

Slot F is for the Data Logging Option and requires no connections.

Slot G is dedicated to the Multiple Setpoint Select Card. This option allows the Model 830 to retain more than one demand setpoint and automatically switch between setpoint values.

Slot H is dedicated to the Timed Override Option Card. Using this option allows for up to eight momentary contact switches to be located about the facility so that temporary (timed) overrides can be manually initiated by facility personnel.

Slot I is for an additional Serial Communication Card similar to slot A except it is used as a local serial port in which a keyboard/printer, CRT terminal, or computer can be directly connected.

Slots J and K are for the Temperature Input Cards. By adding these cards, the Powersense 830 is able to monitor up to 8 temperature inputs.

Slots L, M, N, and O are not used at this time. Do not insert any cards into these slots during normal operation.

Slot P is for the Strip Chart Recorder Output Card.

For complete installation and operating instructions on these user options, locate and read the appropriate chapters in this manual.

2.8 Final Assembly

Replace the front case assembly and re-connect internal cabling. At this time, the 24 VAC input system power connections should be made.

Three wires for the 24 VAC 50/60 Hz input power are located inside the unit in the upper right corner of the front case assembly. For safety, and to prevent possible damage to the unit from the effects of static electricity, the 830 should be grounded (earth ground) through the green ground wire as shown in Figure 2.11.

Figure 2.11: Grounding the 830

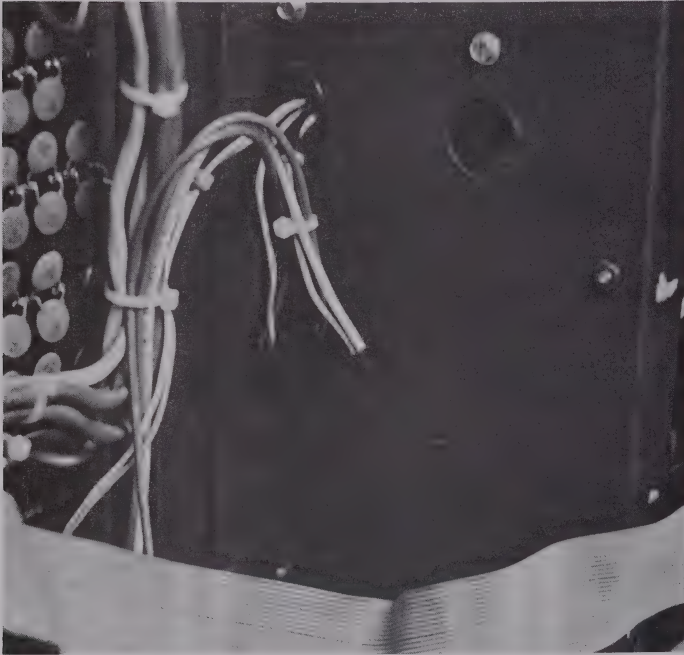


Figure 2.12: Wire Size and Run Lengths

<u>Wire Size (Stranded)</u>	<u>Maximum Separation Between Power Transformer And Powersense 830 (in feet)</u>
16	30
14	50
12	80

The 24 VAC power should be connected to the black and white wires. Since both of the 24 VAC input power lines are isolated (floating) in the 830, one of these lines should be grounded as a precautionary measure. This greatly reduces the hazard to the operator in the event there is a short circuit of one input line to a higher, class 1 voltage.

Input power is furnished by a 10CVA, 24 VAC transformer supplied with the unit. To reduce electromagnetic interference (EMI), this transformer must be used only to power the 830. All other relay power should be supplied by additional low voltage transformers. Install the 24 VAC power transformer in a relay panel within reasonable distance of the unit.

The 24 volt lines running from the transformer to power the 830 must be able to carry 4 amps with a total loop resistance of 0.5 ohms or less. See Figure 2.12 for wire size and maximum run lengths.

If run lengths are longer than those shown in Figure 2.12 for the corresponding wire size, a significant line voltage drop may occur. This can create a low voltage condition for the 830. Run lengths can be increased by running the smaller diameter wire sizes in parallel; e.g., a double 16 gauge pair allows a 60 foot

separation, while a triple 16 gauge pair allows for up to 90 feet. If such a technique is used, make sure that adequate connections are made at each end. Once power is applied, be sure to measure the input voltage to the unit to verify that at least 22 VAC is present on the input power wiring of the 830

It is advised that you install the 24 VAC transformer on a 120 VAC circuit that does not have any highly transient switching loads. The circuit should be on a dedicated breaker that is left switched ON at all times. It is also strongly recommended that you install a 2 amp fuse on the 120V primary side of the power transformer to provide protection against line surges, over voltages, etc.

If the power transformer is located apart from the 830, make sure that its leads are not bundled or run in parallel (within one foot) with any highly transient switching relay loads. All power lines with run length over 10 feet should be twisted together.

Connect a fresh 9 V alkaline battery to the battery connection located on the backside of the front door. Battery power is sufficient to retain schedule memory in case of power failure. The battery must be installed whenever the System Reset switch (inside panel) is pressed or all scheduling and programs will be erased.

2.9 Basic System Programming and Operation

2.9.1 Configuration Switches

The Powersense 830 has a block of configuration switches on the backside of the front panel which should be set before beginning operation.

Open the front door and locate the eight small, white switches on the backside of the door as shown in Figure 2.13. Due to their small size, care should be exercised when setting the switches. Once set, they (except for the diagnostic switch) will rarely require further changes.

Seven of the switches (1-5 and 7-8) are operational. Each switch is in the ON position when it is moved to the right, numbered side of the switch block. Moving the switch away from the number selects the OFF position.

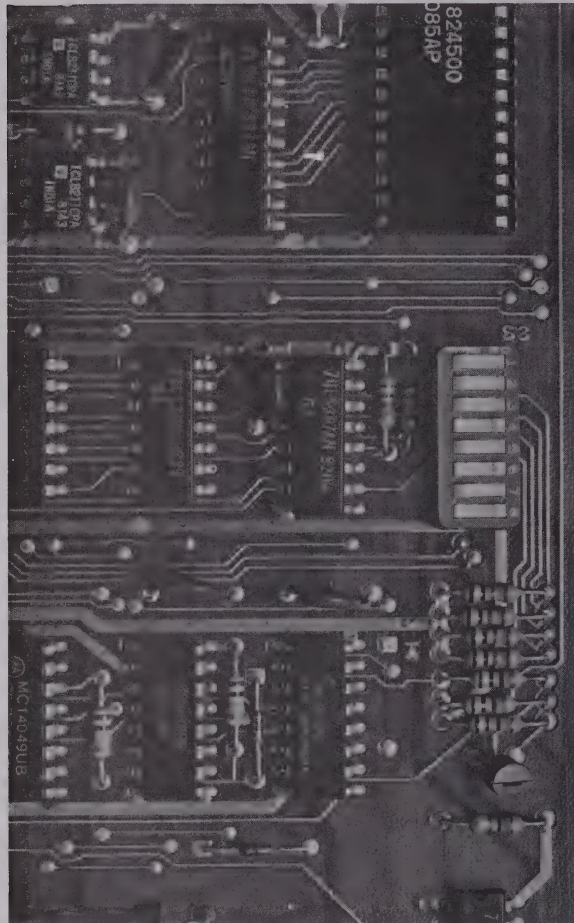


Figure 2.13: Powersense 830 Configuration Switches

Switch number 1 selects keeping time by counting the cycles of the AC line or, if you have an environment which provides a poor or unstable AC line frequency, keeping the time by the internal clock crystal. The ON position selects the AC line to maintain the time of day. The OFF position uses the internal crystal for time keeping purposes. This switch should be ON unless there is specific knowledge of poor regulation of AC line frequency in the facility.

Switch number 2 is a 50/60 Hz switch. The microprocessor needs to know whether the AC service is 50 or 60 Hz, as it counts the number of cycles to measure each second (only if switch 1 is set in the ON position). When it has detected the appropriate number of cycles, the microprocessor will advance the clock one second. The ON position indicates 60 Hz; OFF for 50 Hz. This switch is ignored if Switch No. 1 is set to the OFF position.

Switch number 3 is the automatic setpoint adjustment switch; used only if the Demand Control Option is installed in the unit (see Chapter 3).

Switch number 4 initiates the diagnostic test program for the Powersense 830. The use of the diagnostic test switch will be discussed in the IN CASE OF DIFFICULTY chapter of this manual. For normal operation, this switch should always be in the OFF position.

Switch number 5 is a select switch for the front panel display. This switch initiates alternating displays or selects one of the two displays: TIME/DATE information or DEMAND information. ON selects the alternating display. OFF allows you to select which of the two displays you wish to see. To select only one of the TIME/DATE or DEMAND displays, move the switch to the ON position. Then while watching the front panel display, move the switch to the OFF side when the desired display date appears. If the Demand Control Option is not present this switch should be set to the ON position while the unit is displaying TIME/DATE/TIMER information.

Switch 6 is not presently used.

Switch 7 should be set to the OFF position at all times. In the ON position this switch will disable the low battery detect and low battery indication/alarm feature. If left in the ON position, the unit will not alert the user during a low battery condition and all information stored in memory could be lost in the event of a power failure.

Switch 8 controls the audible alarm feature. When set to the OFF position, it prevents the alarm from sounding during any alarm condition. In the ON position, the alarm will sound whenever the

alarm light on the front panel is flashing. All front panel (red) alarm lights will continue to operate normally regardless of the setting of this switch.

2.9.2 Prompt Lights and Displays

With all of the input and output cards inserted, wired and configured, and the 9V battery connected, you are ready to apply 24 VAC power to the Powersense 830.

Apply power to the 24 VAC power transformer for the Model 830. The front panel of the unit will display a random pattern in the lights for a short period of time. This is normal. The NONE lamp under SETPOINT SELECTED will light and remain lit for up to 60 seconds, whereupon it will change to No. 1 unless an external switch closure is wired to select a different setpoint. If the Demand Control Option is not installed, the NONE light will remain lit at all times. If you have a low battery or no battery installed, the LOW BATTERY light will flash and the audible alarm sound.

To silence the alarm, press the ALARM ACK key.

If a Demand Input Pulse Card is installed and no connections to the pulse initiating demand meter have been made, the ALARM light will flash and the audible alarm will also sound. Press the ALARM ACK key to silence the audible alarm. The alarm occurs because the 830 is looking for a contact closure from the pulse initiating demand meter across connections #1 and #4 or connections #2 and #4 on the terminal blocks corresponding to the slots with the Demand Input Pulse Cards. The Model 830 constantly checks the connections for an open circuit condition to verify that the connection to the demand meter has not been broken. If you wish to operate the unit with no demand meter input connected, install a short piece of wire across the terminals #1 and #4 (or #2 and #4). Alternatively, you may remove the small blue jumper as shown in Figure 2.14 from the Demand Input Pulse Card. This will configure the card for a Form A (2-wire) meter, thus disabling the verification feature of the 3-wire connection.

At this moment, the Powersense 830 has no data entered. When you close the front panel, you will face columns of lights on each side of the 830 and three display windows. These serve three basic purposes: to prompt you through the sequences of steps for entering data; to display data as entered; and to recall (check)

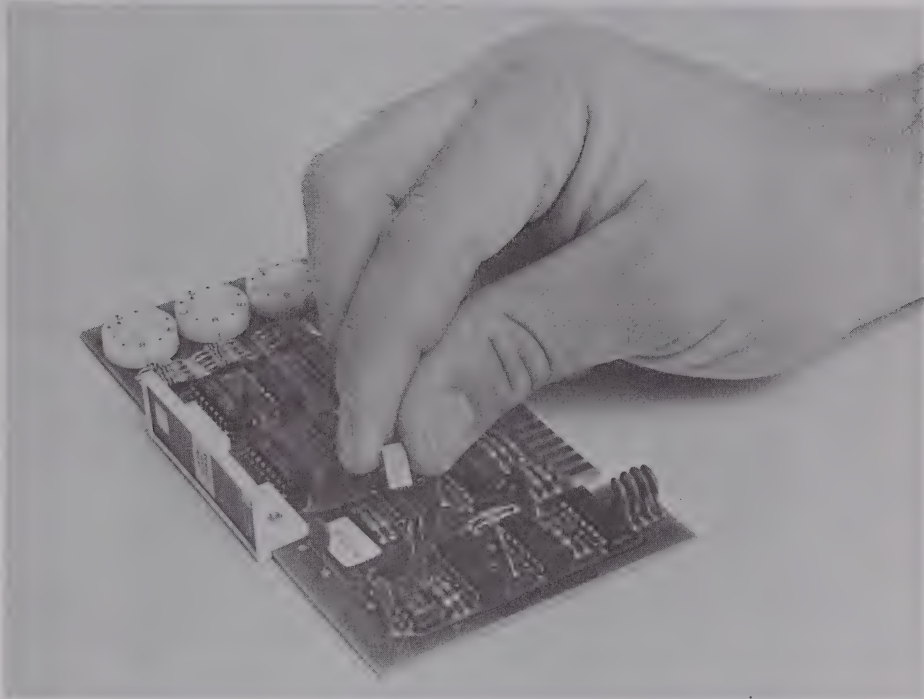


Figure 2.14: Removing Jumper on Demand Input Pulse Card

data previously entered. These functions will be explained in greater detail in the programming section of each chapter in this manual.

Figure 2.15 shows a Powersense 830 front panel with all lights and displays. (The extra circuit lights along the lower right side of the unit are provided by the Expansion Panel).

Locate the keyswitch in the lower left corner of the panel. This is the RUN/CHANGE switch. The 830 normally operates in the RUN mode. Before data can be entered, changed, or cancelled, the keyswitch must be set to the CHANGE position. The front door and RUN/CHANGE keys are different.

Ensure that the RUN/CHANGE switch is in the RUN position and refer only to the lights and displays in the upper half of the front panel. At this time, the three display windows will show one of two sets of data. They may alternate between the time/date/timer and present demand/predicted demand/setpoint on a 5 second interval or they will constantly display the same "trio" of information. This is dependent on the setting of switch No. 5 on the backside of the front door. Recessed and near the upper corners of each display window, there are small lamps that indicate which type of information is being displayed. When



Figure 2.15: Powersense 830 Front Panel

the recessed lights above each window are lit on the left side (TIME/DATE/TIMER), the upper display will show 12:02 A.M.; the middle display will contain 1 01 80 (January 1, 1980); and the lower display will be blank. When the recessed lights above the right side of each window are lit, the upper display will show the present demand (which will be zero if no demand input is yet connected or if the Demand Input Option is not installed); the middle window will show the predicted demand (also zero if no demand input is connected); and the lower window (SETPOINT) will be blank. The meaning of each of the six possible display values is as follows:

TIME - Present time-of-day in 12 hour AM/PM format. 12 00 A IS
NOON; 12 00 P IS MIDNIGHT.

DATE - Current date using Gregorian calendar in month/day/year format.

TIMER - Time remaining in hours and minutes for any circuit(s) currently ON due to temporary ON periods via TIMER key.

PRESENT DEMAND - Facility demand in kilowatts as averaged over previous N minutes where N is the length of the demand interval as entered via the SETPOINT key. The Model 830 attempts to prevent this value from ever exceeding demand SETPOINT value as displayed in lower window and entered via SETPOINT key.

PREDICTED DEMAND - Essentially an instantaneous demand reading. Upper display window will eventually indicate this value if nothing in the facility is turned ON or OFF for the next N minutes where k is length of demand interval.

SETPPOINT - Desired upper limit of facility demand. The Model 830 acts to prevent the value of PRESENT DEMAND from ever exceeding this value.

The Tuesday light (upper left) will be lit. The STD light (just below the light labeled SPECIAL) will be lit because the unit assumes operation Standard Time (as opposed to Daylight Savings Time) upon initial power up.

On the lower half of the front panel, the only lights which should be lit at this time are for the designated circuits (a light for each installed Circuit Master Card).

At this point, you may have noticed that the unit has started to switch circuits ON starting with Circuit 01. This is normal. The Model 830 will continue to sequentially switch ON each circuit in numerical order until all circuits in the system are ON. They will remain ON and no load control will be initiated until the time and date are entered into the system via the CLOCK key or via the Serial Communications Option. This feature is designed to

prevent all loads from being switched OFF should the unit lose memory due to extensive power failure, nearby lightning, etc.

If you have set the manual override switches on any of the Circuit Master Cards to either the OPEN or CLOSED positions (instead of AUTO), you may see either a flashing red or green Circuit Status Indicator corresponding to the number of the affected circuit. The solidly lit lamp indicates the true status of the circuit and the flashing lamp indicates the status of the circuit as desired by the microprocessor.

Now open the front door and check the condition of the internal operating lights, a vertical row of twelve red lights on the back side of the front door. With a fresh 9V battery installed, all of these should be lit to indicate the unit is operating correctly. Any lights not lit indicate that some portion of the Model 830 has failed and you should contact your distributor or Trimax Field Service Department. While we will discuss these lights later, it is important now to note that the bottom light (labeled "CPU") should be flashing. This light indicates correct operation of the microprocessor. If this light is not flashing, the microprocessor in the Powersense 830 is not operating.

If problems are encountered at this point, refer to the IN CASE OF DIFFICULTY chapter of this manual. DO NOT PROCEED FURTHER.

Next, close the front door and position the RUN/CHANGE keyswitch to CHANGE. The entire front panel display will go blank. However, in the CHANGE mode, the Model 830 will continue to operate as previously programmed while you input the desired data changes. The unit is expecting some form of user operation (programming) sequence.

 Note

While in the RUN mode, the Model will recognize only one user operation--a data checking sequence initiated by the CHECK key. (See the programming sections of this manual for functions of this key.)

Before entering program data, examine all of the prompt lamps by reading down the lights from the upper left hand corner.

In the RUN mode, the Monday through Sunday lights designate the present day of the week. In the CHECK or CHANGE mode, they specify the day of the week for which the data is being checked or entered.

On the opposite (right) side of the unit, the SETPOINT SELECTED lights are used for checking or entering setpoint information and to display the setpoint being used currently (RUN). Note that these indicators are not used unless the Demand Control Option is installed in the unit. The value of the current setpoint is shown in the lower display window on an alternating basis whenever the keyswitch is in the RUN position.

The ZONE number lights are used in the RUN mode when the Timed Override option is installed. The ZONE lights are also used in conjunction with checking temperatures (TEMP) in designated areas of the building if the Temperature Input Option is installed.

The CIRCUIT status lights on the lower right side of the unit operate in two ways. (1) In the RUN mode, the lights for each circuit with a Circuit Master Card installed will show the current status of a load -- either ON (green), SHED (amber), or OFF (red). If a circuit is overridden, a steady light indicates the actual status of the circuit while a flashing light indicates the desired status. For example, if circuit 01 is overridden ON by the Manual Override Switch when it should otherwise be OFF, the ON (green) light for circuit 01 will be steadily lit while the red OFF light will flash. (2) In the CHANGE or CHECK mode, the green lights designate the circuit being referenced, and the red lights designate the schedule number.

The amber lights below the Monday through Sunday lights in the upper left corner are self-explanatory. SPECIAL indicates selection of either the eighth or ninth day operating schedule. STD and DLS indicate in the RUN mode whether the current time standard displayed is Standard or Daylight Savings Time.

LOW BATTERY is self-explanatory. When this light flashes, the 9V battery should be replaced as soon as possible.

SETPOINT EXCEEDED functions only with the Demand Control Option installed and indicates that the entered setpoint value has been exceeded.

ALARM LEVEL indicates that the designated alarm level has been exceeded. This operates only with the Demand Control Option.

ALL CKTS SHED informs you that all loads which can be shed within the priority scheme have been shed. This feature is only used when the Demand Control Option is installed.

ALARM flashes when any of the above described alarm conditions exist in the system.

ERROR means that there has been an error in the manner in which data has been checked or entered. When this light flashes, press CLEAR key to erase the erroneous entry and re-enter new data.

Figure 2.16 shows a close-up of the 7-segment LED display windows for the Powersense 830. The displays are arranged so that there are five displayable characters in the top and bottom windows, and six characters in the middle display. While in the RUN mode, the displays alternate between TIME, DATE (and TIMER value if any), and the PRESENT DEMAND, PREDICTED DEMAND and SETPOINT. You can select a permanent display of one set of values by switching off the alternating display feature (see prior section 2.9.1 CONFIGURATION SWITCHES).

The 16 white data entry keys are shown in Figure 2.17. Many of these keys have a double function. For example, the key labeled "1" has a secondary label "MON". During programming, the Powersense 830 will know which function is being performed because of the context of use in the programming sequence. If the DAY prompt light is lit, then the key labeled "Mon"/"1" means Monday.

Figure 2.18 shows a close-up of the Model 830 black function keys. These keys are used to initiate the sequence to tell the microprocessor what to do. They are all single function keys.

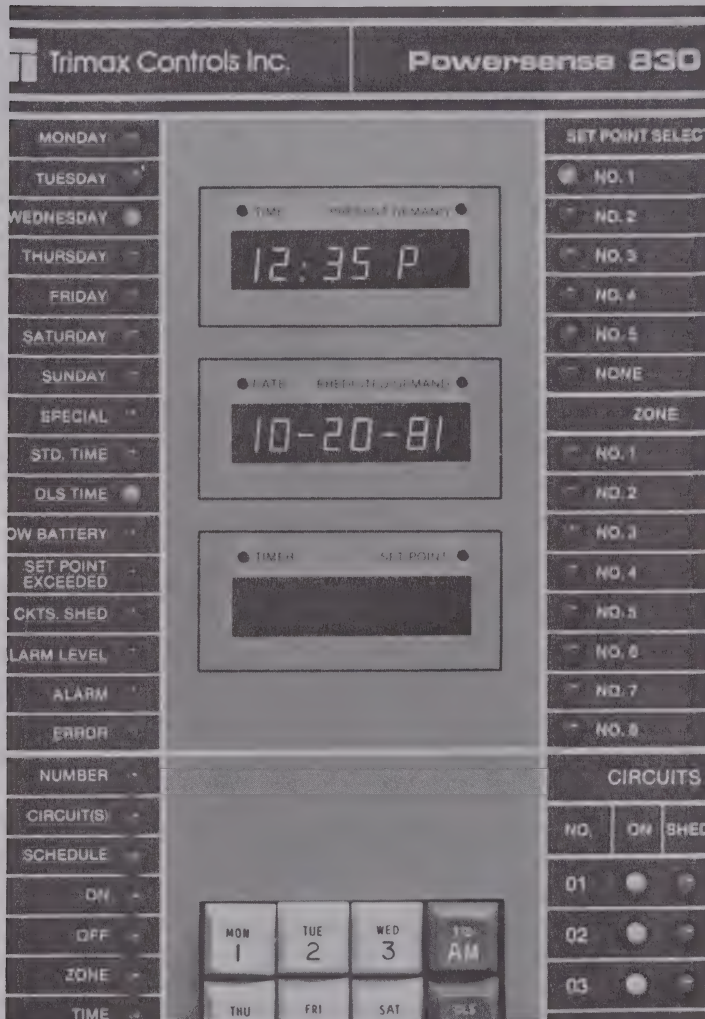


Figure 2.16: LED Display Windows

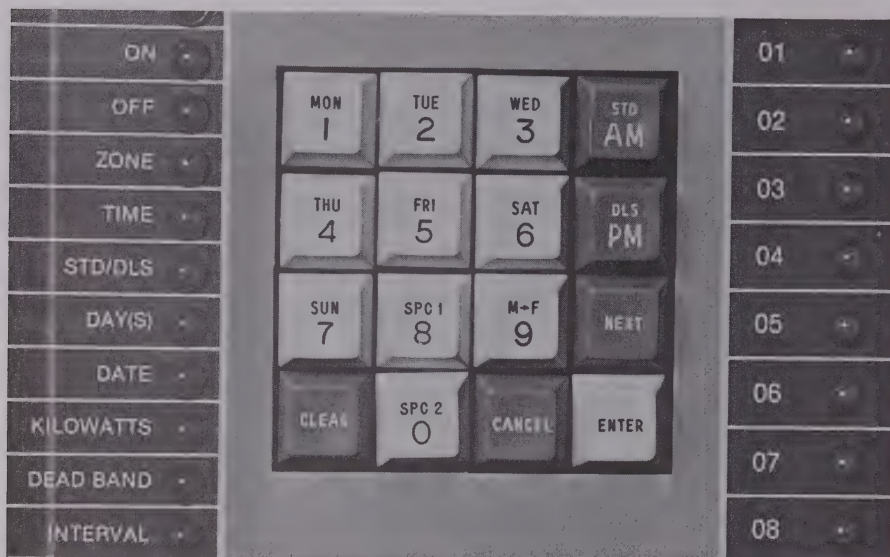


Figure 2.17: Data Entry Keys

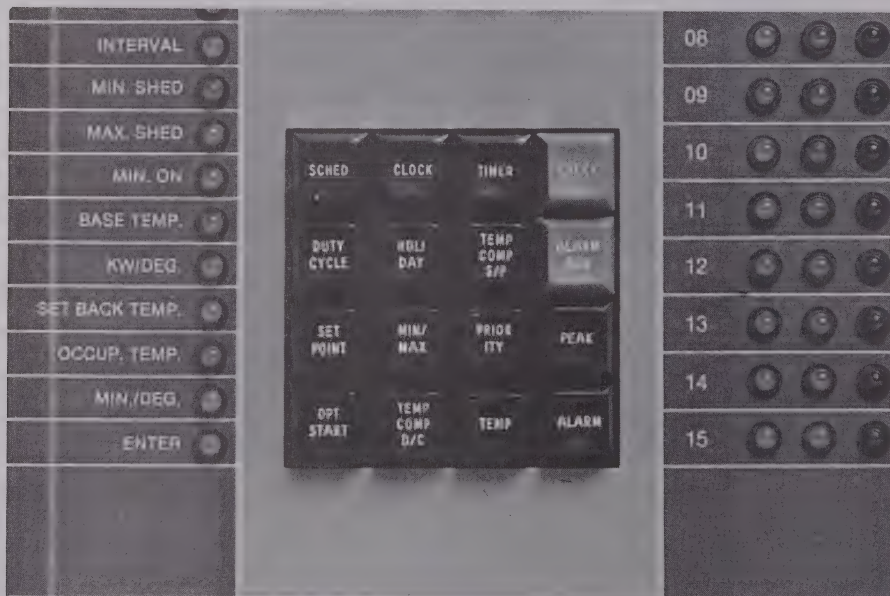


Figure 2.18: Function Keys

Both Figures 2.17 and 2.18 show a series of gray keys, which provide the following capabilities: CLEAR a display, CANCEL data currently in memory, ACKnowledge an audible alarm, CHECK current data, and advance to the NEXT prompt if all values of a particular entry have been entered.

The function keys initiate any one of the prompt lights on the lower left side of the unit. These green lights are used only during the CHECK or ENTER/CHANGE phases of operation. They are all green, light one at a time, and function to guide the operator through each step of the programming sequence. Their functions are as follows:

NUMBER requests a 1 or 2 digit response to an operation. Example: If you press CHECK followed by HOLIDAY, the green number prompt will light, asking you which holiday number of the date list (01-30) you wish to check.

CIRCUIT(S) is lit any time a function key is pressed to check or enter/change data for an individual circuit. The unit expects entry of a 2-digit circuit number in the range of 01 to 30.

SCHEDULE, when lit, allows designation of a schedule number (1-9) for which data are being entered/changed or checked. This prompt

is activated when entering information via the SCHED, DUTY CYCLE, or TEMP COMP DUTY CYCLE function keys.

The ON and OFF lights are prompts in response to SCHED or DUTY CYCLE. The unit is requesting either a time of day (followed by AM or PM) or duration in hours and minutes.

ZONE functions only with the Timed Override Option or Temperature Input Option installed, and requests a single digit (1-8) designation for temperature or timed override zones.

TIME is a prompt light in response to CLOCK or TIMER. It requests either time of day followed by AM or PM, or a temporary time extension duration (hours and minutes).

STD and DLS are prompts in response to the CLOCK sequence. After you have entered a time of day and date, the Model 830 needs to know whether Standard or Daylight Savings Time is in effect.

DAY(S) requests the day of the week when you use the CLOCK function, or one or more days of the week in response to the SCHED function. This prompt is also used by the HOLIDAY key to request the consecutive number of days to use the eighth or ninth day programs.

DATE, when used with the CLOCK sequence, requests the current day when the system is initialized. When used with the HOLIDAY Function key, it wants a particular date that is designated for replacement with one of the two special day programs. The DATE prompt is also used to specify the change-over date from Standard Time to Daylight Savings Time (and vice-versa)

Before entering any more information or commands, it is recommended that you become familiar with the remaining prompt lights, which, in general, are concerned with optional capabilities of the Powersense 830. A description of the function of each prompt follows:

KILOWATTS requests the maximum demand level for the facility in kilowatts; enter a value in the range of 2 to 9999. This prompt operates only when the Demand Control Option is installed.

DEADBAND requests an offset value to establish a deadband region. This prompt is used by the Demand Control Option and the Temperature Compensated Duty Cycle function (see the appropriate chapters for explanation).

INTERVAL specifies the width in time of the sliding window (see Chapter one of this manual, "History of Demand Charges"). This

prompt requests entry of a value in minutes between 0-59 or the designation 100 for 1 hour. The INTERVAL prompt is a function of the Demand Control option.

MIN SHED, MAX SHED, MIN ON are prompt lights that request a time value in hours and minutes; range 0 minutes and 12 hours and 59 minutes (0 to 1259). They are available in the basic system; however, they are used extensively when the Demand Control Option is installed. MIN SHED prevents loads from excessively short shed cycles (OFF periods), preventing damage to compressor equipment. MAX SHED prevents critical equipment from being out of service for inordinate periods of time. MIN ON sets the minimum amount of time that the load, once restored, must remain ON. Using these MIN/MAX values, the shedding of a load can be handled as follows: When shed, this load must remain shed for at least 5 minutes, however, no more than 10 minutes and when restored it must run for a minimum of 20 minutes. This type of control capability is required when demand limiting is performed on refrigeration loads.

BASE TEMPERATURE requests entry of a reference temperature for variance of either the duty cycle ON time or the value of a setpoint in kilowatts. This prompt is used by the Temperature Input Option.

KW/DEG is a prompt, initiated by the TEMP COMP SETPOINT sequence, which requests the number of kilowatts variance per degree of outside temperature, and functions only when the Temperature Input and Demand Control Options are both installed.

SETBACK TEMP requests entry of temperature at which the building should be kept when not occupied. This is also a function of the Temperature Input Option.

OCCUP TEMP is a prompt light that requests the target temperature that the 830 is to achieve by the start of working hours. This prompt is used only by the Temperature Input Option. It is important to note that THE 830 PERFORMS NO TEMPERATURE CONTROL DURING THE SCHEDULED ON PERIOD OF A CIRCUIT. THIS FUNCTION IS LEFT TO THE FACILITY THERMOSTATS.

MIN/DEG is a prompt light in response to the TEMP COMP DUTY CYCLE function to vary the ON portion of the duty cycle pattern as a function of indoor or outdoor temperature. This will be discussed in greater depth in the Temperature Input Option Chapter of this manual.



1) Always follow instructions from the prompt lights when entering or changing data.

2) If a prompt light does not appear after an entry (or when the entire entry is completed), press NEXT to advance to the next prompt.

3) If a mistake is made in an entry or if the ERROR light flashes, press CLEAR once to correct the mistake. The last prompt light will reappear -- now, re-enter data.

4) Pressing the CLEAR twice will clear the LED displays in the CHANGE mode or will display time and status in the RUN mode. The unit will automatically initiate a double clear sequence in approximately 70 seconds if no keys are pressed.

2.9.3 Initializing the Powersense 830

After the initial setting of the Configuration Switches and the power up of the Model 830, it is necessary to initialize the system before proceeding to input data. This is accomplished by setting the current time and date. Follow these steps:

STEP	USER ACTION	PROMPT
1	Position the RUN/CHANGE switch to CHANGE	
2	Press CLOCK	TIME
3	Enter the current time of day and whether it is a.m. or p.m. (i.e., 216 followed by the PM key to enter 2:16 p.m.)	DAY(S)
4	Enter the day of the week (e.g., WED).	STD/DLS
5	Enter the current time standard (STD or DLS data entry key).	DATE
6	Enter the day's date (July 20, 1983 would be entered as 7 20 83). There will be no new prompt at this point because the Powersense 830 is unable to tell when you have entered the final digit of the date. The NEXT key is used to inform the 830 that you have completed the entry and wish to proceed.	
7	Press NEXT The enter prompt is asking for one of two things: either press the ENTER key to accept data or press CLEAR twice in case you have entered the date improperly.	ENTER

- 8 Press **ENTER**. The displays will go blank, the data has been entered.
- 9 Position the RUN/CHANGE switch to RUN. The time and date information will appear in the upper two display windows. (Note: It may alternate every 5 seconds with demand information depending on the setting of switch 5 on the backside of the front door.)

2.9.4 Functions and General Programming

A good understanding of the functions of the Powersense 830 is necessary before starting to program the unit. This subsection will discuss the function keys of the BASIC Model 830 and some general guides to initiating the programming sequences. Within each programming section, the enter/change, check, and cancel sequences for the basic unit will be explained in step by step format.

Figure 2.19 shows the arrangement of the 16 function keys and the 16 data entry keys. These will not necessarily be discussed in the order illustrated, but in a grouping which develops a better understanding of programming operations.



Figure 2.19: Arrangement of the Function Keys
& the Data Entry Keys

The SCHED function key initiates the ON/OFF time sequence for any circuits with Circuit Master Cards installed. Nine separate schedules plus duty cycling duration periods can be programmed for each circuit.

The CLOCK function key has been described in previous pages. For more information, see PROGRAMMING SEQUENCE, "Updating Time Only."

The TIMER function allows a temporary extension of ON times for one or more circuits. TIMER takes precedence over normal ON/OFF schedules and duty cycle control. Periodically you should check which circuits you have on TIMER and evaluate the impact on normal operations. TIMER is also used to program the Timed Override Option, if present.

DUTY CYCLE is used to initiate Duty Cycle entry sequences for any circuit in the Powersense 830 that has a Circuit Master Card installed.

HOLIDAY allows designation by date those days for which the special (8th or 9th day) schedule is to be used in lieu of the normal schedule for the designated day. Up to 30 individual holiday dates may be entered with up to 99 consecutive holidays for each date.

CHECK initiates the check sequence (mode) for information currently stored in the Powersense 830. Checking may be done when the unit is in either the RUN or the CHANGE mode. If the unit is in the CHANGE mode when the sequence is completed, all displays will remain blank until further operator action or until the RUN/CHANGE switch is set to the RUN position.

ALARM ACK is used to acknowledge and terminate an audible alarm.

2.9.5 Programming the Clock

After initializing the Powersense 830, follow these steps to set the system clock.

When setting the clock, the time is set to the hour and minute you have entered and 00 seconds. Updating and synchronizing the clock to another time source is easily accomplished. To synchronize the Powersense clock with the other clock, which you have selected as a reference, enter the time to the next full minute but do not press ENTER until the synchronizing source matches the time value appearing in the display window. For example, if you wish to

synchronize the clock with one that currently reads 2:15 PM, set the Powersense 830 clock to 2:16 PM, and delay pressing ENTER until the reference clock changes to 2:16 PM.

Setting the Clock

STEP	USER ACTION	PROMPT
1	Position RUN/CHANGE switch to CHANGE	TIME DAY(S) STD/DLS
2	Press CLOCK	
3	Enter time of day, AM or PM	
4	Enter day of the week (Mon , Tue , etc)	
5	Enter the current time standard (STD for Standard Time, DLS for Daylight Savings Time).	
7	Enter date (January 1, 1983 = 10183).	DATE
8	Press NEXT	ENTER
9	Press ENTER The front panel will go blank; the system clock has been set.	
10	Position RUN/CHANGE switch to RUN	

Updating the Clock

STEP	USER ACTION	PROMPT
1	Position RUN/CHANGE switch to CHANGE	TIME DAY(S)
2	Press CLOCK	
3	Enter new time of day, AM or PM	
4	Press ENTER The front panel will go blank; the internal clock changes to the new time only, the original day of the week, time standard, and date remain the same.	
5	Position RUN/CHANGE switch to RUN	

2.9.6 Programming Time Standard Transitions

The Powersense 830 has the ability to automatically adjust the system clock for the transitions between Standard Time and Daylight Savings Time, and vice-versa. To accomplish this transition, the Model 830 will have to be programmed with the dates of the transitions. Use the programming charts in this section to select and cancel the transition dates.

You can preprogram a STD or DLS time transition by entering the date on which you wish it to occur. However, the date entered must be a Sunday. If not, the transition will not be made.

Select Time Standard Transitions

STEP	USER ACTION	PROMPT
1	Position RUN/CHANGE switch to CHANGE	
2	Press [STD] for a transition to Standard Time from Daylight Savings Time, or [DLS] for a transition to Daylight Savings Time from Standard Time.	LATE
3	Enter the date that the transition is to take place (this date must be a Sunday).	
4	Press [NEXT]	ENTER
5	Press [ENTER]	
6	Position RUN/CHANGE switch to RUN	

After pressing enter, the transition date has been entered into memory. On the Monday before the designated transition day the STD or DLS light will begin to flash. The light will continue flashing until 2:00 AM on the designated Sunday. At that time, the current system time value in the upper window will be advanced or setback by one hour.

Cancel Time Standard Transitions

STEP	USER ACTION	PROMPT
1	Position RUN/CHANGE switch to CHANGE	DATE ENTER
2	Press STE or LLS	
3	Press CANCEL	
4	Press ENTER	
5	Position RUN/CHANGE switch to RUN The appropriate pending time standard transition is then cancelled.	

2.9.7 Programming Schedules

Follow the step-by-step charts in this section to ENTER/CHANGE, CHECK, or CANCEL on/off schedules.

If schedule information is not entered for any of the 9 schedules of a particular circuit on a specific day, including either of the special (holiday) days, the circuit will remain OFF until the next scheduled ON time of a subsequent day.

To schedule a continuous 24 hour ON time, you must enter the same value for both the ON and OFF times, e.g., ON 8:00 AM and OFF 8:00 AM. The circuit will be switched ON at 8:00 AM on Day 1 and will be switched OFF at 8:00 AM on Day 2. You can enter an ON time that appears to occur after the OFF time. If, for example, you

set a circuit's ON time as 7:00 AM and its OFF time as 5:00 AM, the circuit switches ON at 7:00 AM on Day 1 and OFF at 5:00 AM on Day 2.

If required, each circuit can be programmed with an ON time starting on one day and the OFF time terminating on the next day up to 24 hours later. The starting day and ON time determine the scheduling priority. As an example, if the next day is a holiday, any normal schedules running past midnight will be completed before any holiday schedules take effect.



FOR ALL TIME SCHEDULING PURPOSES, 12:00 PM IS MIDNIGHT
AND 12:00 AM IS NOON. AM begins one minute after 12:00
midnight and PM begins one minute after 12:00 noon.



The Powersense 830 can retain up to 679 pairs of ON/OFF schedule times plus duty cycle ON/OFF duration times. Each circuit may be programmed with a maximum of 90

pairs (9 schedules for all 7 weekdays, an eighth and ninth day schedule, and 9 duty cycle schedules).

If you enter more than 679 total pairs, the 830 will cause an error condition and the displays will appear as:

EEEE

N

679

The value of N indicates the number of pairs available to the system before your last entry. For example, if there were 3 entries left before exceeding the maximum, the display will read:

EEEE

3

679

To correct the error, press CLEAR twice. Your last entry will not be entered. You may now program the remaining ON/OFF pairs if you desire.

Enter/Change On/Off Schedules

STEP	USER ACTION	PROMPT
1	Position RUN/CHANGE switch to CHANGE	
2	Press CHGEL	CIRCUIT(S)
3	Enter a 2-digit circuit number in the range of 01 to 30	SCHEDULE
4	Enter a single digit schedule number in the range of 1 to 9. The OFF (red) indicator for the circuit with the corresponding number will light.	
5	Enter ON time, followed by AM or PM	CL OFF
6	Enter OFF time, followed by AM or PM	LAY(S)
7	Press: (A) One or more days of the week and/or, (B) M-F for designation of Monday-Friday, (C) SPC 1 or SPC 2 to specify that on/off times entered are to be used for this circuit whenever a holiday is declared via the holiday key.	
8	Press NEXT	ENTER
9	Press ENTER . The display will clear and the new schedule data is entered in memory.	
10	Position RUN/CHANGE switch to RUN	

Check On/Off Schedules

STEP	USER ACTION	PROMPT
1	Press CHECK	
2	Press SCHED	CIRCUIT(S)
3	Enter a 2-digit circuit number in the range of 01 to 30	LAY(S)
4	Press any day desired (including SPC 1 or SPC 2 , do not press M-F). The ON/OFF times for schedule No. 1 are displayed.	
5	Press NEXT to display schedule No. 2, again for schedule No. 3, etc. The OFF status indicator (red) will light for the circuit having same number as the schedule displayed (1-9).	
6	Repeat the above sequence from step 4 to check other days.	
7	Press CLEAR	CIRCUIT(S)
8	Repeat the above sequence from step 3 to check the other circuits.	
9	Press CLEAR twice to leave the schedule check mode.	

Cancel an On/Off Schedule

STEP	USER ACTION	PROMPT
1	Position RUN/CHANGE switch to CHANGE	
2	Press [SCHED]	CIRCUIT(S)
3	Enter a 2-digit circuit number in the range of 01 to 30.	SCHEDULE
4	Enter a single digit schedule number in the range of 1 to 9.	ON
5	Press [CANCEL]	DAY(S)
6	Press: (A) one or more days of the week, and/or (B) [M-F] to cancel Monday thru Friday schedules, and/or (C) [SPC 1] or [SPC 2] as desired to cancel holiday ON/OFF time schedules for designated circuit.	
7	Press [NEXT]	ENTER
8	Press [ENTER] . The displays will clear and the ON/OFF schedule is cancelled.	
9	Position the RUN/CHANGE switch to RUN.	

Optional Routine to Cancel all 9 On/Off Schedules of One or More Circuits

STEP	USER ACTION	PROMPT
1	Position RUN/CHANGE switch to CHANGE	
2	Press [SCHED]	CIRCUIT(S)
3	Press [CANCEL]	CIRCUIT(S)
4	Enter 1 or more 2-digit circuit numbers in the range of 01 to 30. The ON (green) status indicator for each circuit will light.	
5	Press [NEXT]	DAY(S)
6	Press: (A) one or more days of the week, and/or (B) [M-F] to cancel all Monday thru Friday schedules, and/or (C) [SPC 1] or [SPC 2] as desired to cancel holiday ON/OFF time schedules for designated circuits.	
7	Press [NEXT]	ENTER
8	Press [ENTER] . The displays will clear and all 9 ON/OFF schedules for the designated circuits are cancelled.	
9	Position the RUN/CHANGE switch to RUN.	

2.9.8 Programming Duty Cycles

For each circuit programmed for DUTY CYCLE operation, ON and OFF times can be independently set from 1 minute up to 12 hours and 59 minutes. Keep in mind that the Powersense 830 recognizes one hour as 100. Therefore, 2 hours is 200, 5 hours is 500, and so on.

The ON portion of the duty cycle pattern begins with the scheduled ON time for the circuit, followed by the OFF portion, etc. Cycling will continue until it is stopped by the next scheduled OFF time. However, one exception to this system is the use of the TIMER. The TIMER function (and Timed Override Option, if installed) overrides duty cycling to full ON for any circuit(s) to which it is assigned and active.

The Powersense 830 will allow "overlapping" of schedules on the same day and circuit (ie., Schedule 1 of Circuit 01 on Monday may be scheduled ON from 8:00 AM - 2:00 PM while Schedule 2 may be scheduled to operate from 11:00 AM - 5:00 PM. Thus, Circuit 01 would operate continuously from 8:00 AM - 5:00 PM). The 830 also permits entry of different DUTY CYCLE ON/OFF times for the two

schedules. In this case, the unit will switch ON the circuit if either of the two schedules calls for the circuit to be ON during the overlap period; both schedules must have coinciding OFF periods in their respective DUTY CYCLE patterns for the circuit to be switched OFF.

There are many situations in which indiscriminate shedding of loads, even on a priority basis to reduce demand, are not possible because of customer or employee comfort, safety, production, or equipment demands. These problems can frequently be solved by duty cycling certain deferrable loads to limit overall demand.

In using the 830 to duty cycle equipment, (such as rooftop air conditioning units) for purposes of limiting peak demand as well as overall consumption, it is suggested that the units be divided equally (or nearly equally) among several circuits of the 830. To limit peak demand, the overall schedule and duty cycle pattern should be set up such that, at any given time, one less than the total of 830 circuits used for duty cycling are operating concurrently. To rotate the OFF circuit among the total circuits used to produce a uniform pattern, duty cycle and schedule patterns may be determined as follows: -

Let:

N = the number of 830 circuits used for duty cycle rotation.

T = the total time in minutes for the complete cycle before
it is repeated.

DC (ON) = Duty Cycle ON time in minutes.

DC (OFF) = Duty Cycle OFF time in minutes.

T (START) = Time of day for start of the rotating cycle for
one of the N circuits.

Assume, for the purposes of this example, that T=60 min, and N=6
circuits.

Then:

$$(1) \text{ DC (OFF) } = \frac{T}{N}$$

$$(1a) \text{ DC (OFF) } = \frac{60}{6} = 10$$

$$(2) \text{ DC (ON) } = T - \text{DC (OFF)}$$

$$(2a) \text{ DC (ON) } = 60 - 10 = 50$$

Notice that T(START) for each circuit should be staggered by DC
(OFF) as shown in the following schedule.

If the rotating cycle were required from 8:00 AM to 5:00 PM, then the following schedule and duty cycle should be set for the days desired:

<u>CIRCUIT NO</u>	<u>SCHEDULE</u>		<u>DUTY CYCLE</u>	
	<u>ON</u>	<u>OFF</u>	<u>ON</u>	<u>OFF</u>
01	7:10 AM	5:00 PM	50	10
02	7:20 AM	5:00 PM	50	10
03	7:30 AM	5:00 PM	50	10
04	7:40 AM	5:00 PM	50	10
05	7:50 AM	5:00 PM	50	10
06	8:00 AM	5:00 PM	50	10

In this example, the start times [T (START)] are staggered by 10 minutes, the OFF time of the DUTY CYCLE. If the period of time (T) were 30 minutes (25 ON and 5 OFF), the start times would be staggered by 5 minutes instead of 10.

With this pattern, only 5 out of 6 circuits will be on at any given time of the day. The pattern is terminated by the OFF time entered in the SCHEDULE sequence.

To program DUTY CYCLES, use the following charts to ENTER/CHANGE, CHECK, or CANCEL duty cycles:

Enter/Change Duty Cycles

STEP	USER ACTION	PROMPT
1	Position RUN/CHANGE switch to CHANGE	CIRCUIT(S)
2	Press DUTY CYCLE	
3	Enter a 2-digit circuit number in the range of 01 to 30. The ON status indicator for selected circuit will light.	
4	Enter a single digit schedule number in the range of 1 to 9. The OFF (red) indicator for the circuit with the corresponding number will light.	SCHEDULE
5	Enter Duty Cycle ON time duration in hours and minutes. Range: 0 min-12 hrs, 59 mins.	ON
6	Press NEXT	OFF
7	Enter Duty Cycle OFF time duration in hours and minutes. Range: 1 min-12 hrs., 59 minutes.	ENTER
8	Press NEXT	
9	Press ENTER The display will clear and the new Duty Cycle data is entered in memory.	
10	Position RUN/CHANGE switch to RUN	

Check Duty Cycles

STEP	USER ACTION	PROMPT
1	Press CHECK	CIRCUIT(S)
2	Press DUTY CYCLE	
3	Enter circuit number. The Duty Cycle ON/OFF durations for schedule 1 are displayed. To review further schedules, press NEXT . A zero will be displayed if no Duty Cycles have been entered.	CIRCUIT(S)*
4	Press CLEAR twice to leave the schedule check mode.	

* Circuit(s) prompt will remain lit after step 3 to allow you to check additional circuits.

Cancel a Duty Cycle

STLP	USER ACTION	PROMPT
1	Position RUN/CHANGE switch to CHANGE	
2	Press DUTY CYCLE	CIRCUIT(S)
3	Enter a 2-digit circuit number in the range of 01 to 30.	SCHEDULE
4	Enter a single digit schedule number in the range of 1 to 9.	ON
5	Press CANCEL	ENTER
6	Press ENTER	
9	Position RUN/CHANGE switch to RUN	

Cancel all 9 Duty Cycle Schedules for One or More Circuits

STLP	USER ACTION	PROMPT
1	Position RUN/CHANGE switch to CHANGE	
2	Press DUTY CYCLE	CIRCUIT(S)
3	Press CANCEL	CIRCUIT(S)
4	Enter one or more 2-digit circuit numbers.	
5	Press NEXT	ENTER
6	Press ENTER	
7	Position RUN/CHANGE switch to RUN	

2.9.9 Programming Min/Max Values

The values of minimum shed and minimum on have a global effect on the operation of each circuit to which they are assigned. These values are used any time a circuit is switched on or off, not just when the circuit is shed or restored by the demand control function. For this reason, this function is available in the Basic Unit and can be used to "guard" against excessively short

duty cycle patterns, etc. Care should be exercised when selecting duty cycle times, On/Off schedules, etc., so as not set up conflict with MIN/MAX values.

To program MIN/MAX values, follow the step-by-step charts in this section. It is important to note, the permissible time range for all of the values is between zero (0) minutes and 12 hours and 59 minutes (1259). An entry of zero (0) will negate any minimum/maximum shed or on values (i.e., for a circuit with a min shed value of zero, the system can restore the load without consideration of the length of time that it has been shed).

Enter Change Min/Max Values

STEP	USER ACTION	RESULT
1	Position RUN/CHANGE switch to CHANGE	CIRCUIT(S)
2	Press MIN/MAX	
3	Enter circuit number(s) desired. The ON status indicator(s) will light.	
4	Press NEXT	MIN SHED
5	Enter the minimum amount of time that a circuit must remain OFF when switched OFF (for any reason).	MAX SHED
6	Press NEXT	
7	Enter the maximum allowable OFF time that a circuit may remain Off when shed.	
8	Press NEXT	MIN ON
9	Enter the minimum amount of time that a load must remain ON after being switched ON.	ENTER
10	Press NEXT	
11	Press ENTER	
12	Position RUN/CHANGE switch to RUN	

Check Min/Max Values

STEP	USER ACTION	PROMPT
1	Press CHECK	CIRCUIT(S)
2	Press MIN/MAX	
3	Enter circuit number. The upper display window will show the minimum shed; the middle window - maximum shed; the lower window - minimum on.	CIRCUIT(S)*
4	Press CLEAR twice to leave the schedule check mode.	

* Circuit(s) prompt will remain lit after step 3 to allow you to check additional circuits.

Cancel Min/Max Values

STEP	USER ACTION	PROMPT
1	Position RUN/CHANGE switch to CHANGE	CIRCUIT(S)
2	Press MIN/MAX	
3	Enter one or more circuit numbers.	MIN SHED ENTER
4	Press NEXT	
5	Press CANCEL	
6	Press ENTER - Min Shed, Max Shed, and Min On values are set to zero.	
7	Position RUN/CHANGE switch to RUN	

2.9.10 Designating and Programming Holidays

The Powersense 830 is able to retain two holiday programs in memory for use on dates as designated by the user. We generally refer to the 2 holiday programs as Special 1 and Special 2; they are simply additional "day-types" similar to Monday, Tuesday, Wednesday, etc. In this manner, the 830 actually maintains ON/OFF schedules for nine different day-types (Special 1 and Special 2 being the eighth and ninth days).

Each output circuit of the 830 can retain two different sets of ON/OFF schedules for the SPEC 1 and SPEC 2 day-types. These may be unique for each circuit. When a holiday is designated, all circuits will switch to their holiday schedules (SPEC 1 or SPEC 2 as specified by the user) in lieu of their normal daily program.

In order to utilize the holiday capability of the model 830, the user must perform 2 independent steps as follows:

1) For circuits that are to be scheduled ON during any portion of the holiday period, the desired ON/OFF schedules must be entered into the system via the SCHED key. The procedure is very similar to that for entering normal daily schedules. The normal response (as described in the schedule programming charts, section 2.9.7 of this manual) to the CIRCUIT(S), SCHEDULE, ON, and OFF prompts should be followed. At the DAYS prompt, either the SPC 1 or SPC 2 key should be pressed to designate the ON/OFF schedule as that to be used when the appropriate holiday type (1 or 2) is designated via the HOLIDAY key (refer to the Holiday programming charts at the end of this section). Note: Failure to enter any ON/OFF schedule for either the SPC 1 or SPC 2 days of a circuit will cause that circuit to remain OFF during the holiday program is in effect.

2) Once the ON/OFF schedules have been entered for the SPC 1 and SPC 2 days, it is necessary to tell the unit when to use the holiday program, how long to use it, and which of the 2 special programs to implement.

Use the following programming charts to enter/change, check, and cancel holidays:

Enter/Change Holiday Dates

STEP	USER ACTION	PROMPT
1	Position RUN/CHANGE switch to CHANGE	NUMBER
2	Press HOLIDAY	
3	Enter a 2-digit number from holiday list on program entry worksheet. The number will appear in the left side of the upper display window.	
4	Enter 1 or 2 to designate usage of special 1 or special 2 program. Number will appear in right side of top display window.	DATE
5	Enter date of first day of holiday period.	DAY(S)
6	Press NEXT	
7	Enter the number of consecutive days that the holiday period is to be used; range is 1-99.	ENTER
8	Press NEXT	
9	Press ENTER	
10	Position RUN/CHANGE switch to RUN	

Check Holiday Dates

STEP	USER ACTION	PROMPT
1	Press CHECK	NUMBER NUMBER
2	Press HOLIDAY	
3	Enter a 2-digit number from holiday list on program entry worksheet. The number will appear in the left side of the upper display window. Holiday type (1 or 2) appears in the right side of the upper window. Date of holiday is displayed in center window and number of consecutive days appears in lower window.	
4	To examine other dates; 1) Press NEXT to advance through holiday date list; or, 2) enter additional 2-digit holiday numbers.	NUMBER
5	Press CLEAR twice when finished.	

Cancel Holiday Dates

STEP	USER ACTION	PROMPT
1	Position RUN/CHANGE switch to CHANGE	
2	Press HOLIDAY	NUMBER
3	Enter a 2-digit number of holiday to be cancelled.	NUMBER
4	Press CANCEL	ENTER
5	Press ENTER	
6	Position RUN/CHANGE switch to RUN	

2.9.11 Programming Timer

Any and all active circuits can be assigned to TIMER. The value can range from 1 minute to 12 hours and 59 minutes. Each circuit assigned to TIMER will have the same countdown time.

Remember that the Powersense 830 considers an hour as 100. Therefore, the values for 30 minutes, one hour, and 90 minutes are 30, 100, and 130 respectively.

Once the TIMER is started, if you add additional circuits or enter a new countdown value, circuits already assigned to TIMER will be cancelled. So, before changing TIMER, you should always check to see which circuits are under TIMER currently. Always use the CHECK, TIMER function to verify results.

The following charts provide the necessary steps to program TIMER.

Enter/Change Timer Values

STEP	USER ACTION	PROMPT
1	Position RUN/CHANGE switch to CHANGE	
2	Press TIMER	ZONE *
3*	Enter zero (0)	
4	Enter one or more 2-digit circuit number(s). The On indicator for the designated circuit will light.	CIRCUIT(S)
5	Press NEXT	
6	Enter desired time value between 1 min. and 12 hours, 59 mins (1259). This time will appear in the middle display window.	TIMER
7	Press NEXT	
8	Press ENTER	ENTER
9	Position RUN/CHANGE switch to RUN	
	The selected circuit(s) will be switched ON in 15 second intervals (if not previously scheduled ON). The time value entered will be displayed in the lower window and will begin counting down on a minute-by-minute basis.	

* Only if Timed Override Option installed

Check Timer

STEP	USER ACTION	PROMPT
1	Press CHECK	
2	Press TIMER	ZONE *
3*	Enter zero (0)	
4	The on indicators for the circuits currently switched ON due to the timer will light. The original Timer value entered will be displayed in the middle display window and the time remaining will be displayed in the lower window.	
5	Press CLEAR twice to return front panel to normal operation.	

* Only if Timed Override Option is installed

Cancel Timer

STEP	USER ACTION	EXPECTED
1	Position RUN/CHARGE switch to CHARGE	ZONE * CIRCUIT(S) ENTER
2	Press ENTER	
3*	Enter zero (0)	
4	Press CANCEL	
5	Press ENTER	
6	Position RUN/CHARGE switch to RUN	

* Only if time override option is installed

2.10 Operating Hints

2.10.1 Circuit Alarm Condition

The Powersense 830, with the Circuit Master Card configured for Remote Load Sense operation, will verify that a designated load responds to an ON/OFF command and will give it 30 seconds to assume the correct ON of OFF status. If it does not, both visual and audible alarms occur. The audible alarm is silenced by pressing ALARM ACK.

In the case of a manual or external override which switches OFF a circuit scheduled to be ON, the ON Circuit Status Indicator flashes continuously while the red OFF Circuit Status Indicator shows as a steady light. The green ON Circuit Status Indicator will continue to flash until the conflict is resolved. Conversely, overriding a circuit ON that is scheduled to be OFF will cause the ON Circuit Status Indicator to light steadily while the OFF Circuit Status Indicator will flash. No audible alarm will occur for circuits overridden by remote or manual overrides.

2.10.2 Circuit Master Cards

Circuit Master Cards may be removed while the Powersense 830 is in operation. They may also be reinserted into their sockets or new circuits may be added while the unit is in operation. Make sure the card is aligned properly (CLOSED is up) before gently inserting the card. Each Manual Override Switch, however, should be in the OPEN position before inserting the card into an operating unit. ALSO, BEFORE YOU REMOVE A CARD, YOU SHOULD DETERMINE WHAT LOADS IT CONTROLS AND THE EFFECT OF REMOVING THE CIRCUIT MASTER CARD.

When a card is removed, its programmed schedules are not lost. However, you will not be able to check the information for that circuit until the card is reinstalled. Replacing the card will reactivate the previously stored information and produce a normal check operation.

You cannot program a circuit for which no Circuit Master Card is installed. The Circuit Status Indicator will not light and the ERROR light will flash if such an operation is attempted.

By using the CLOSED-OPEN-AUTO manual override switch, located on the front of the Circuit Master Card, each circuit may be manually switched ON or OFF. Additionally, external switch closures such as thermostats, wind-up timers, etc. can be connected to the remote override inputs of each circuit (individually or in groups) either ON or OFF. ON's can be connected with OFF's. If desired, one external switch closure can override a circuit ON while simultaneously overriding another different circuit OFF.

2.10.3 Loss of AC Power/Brown Out

In case of power outage, a fresh 9V alkaline battery will keep the clock running and the stored information intact for up to 5 days. When power is restored, Circuit 01 is switched on immediately if scheduled ON. Thereafter, every 15 seconds, the remaining scheduled circuits will be switched ON if so scheduled. This is done to prevent the initial power surge associated with power restoration after an outage. In planning your circuit assignments, you should install any critical loads on the lower numbered circuits since they are the first to be switched ON after power is restored.

If the power has been off for several days or more while retaining stored information and keeping time on its battery, once power is restored, a few seconds may elapse while the unit calculates current time and advances all the schedules accordingly.

In a brown-out (low voltage) condition of the 24 VAC input power, the Powersense 830 switches all circuits to their selected fail condition (i.e., Circuit Master Cards configured for a Fail-ON will be switched ON and those set for Fail-OFF will be switched OFF). When normal AC line voltage is restored, all circuits and connected loads are immediately switched OFF and then restored to their correct ON/OFF state using the 15-second sequential restore function.

III Demand Control Option

The Powersense 830 may be ordered with up to four optional Demand Input Cards (see Figure 3.1) which permit the unit to monitor KW and KWH usage for the purpose of demand limit control of the facility. The user may elect to install this option in the unit without actually performing load shed operations. When used in this manner, the Model 830 becomes a monitoring tool and a significant amount of useful data can be obtained automatically, especially when used in conjunction with the Data Logging Option and the Strip Chart Recorder Option.

If demand limit load shedding is required, the 830 can be easily programmed to operate as a full demand control unit. Load shedding can be performed on any one or all of the control circuits, using fixed or rotating shed strategies. The MIN/MAX values, discussed in Chapter 2, provide protection against short cycling and long periods of continuous shed time for any load(s).

Facility demand levels may be measured through the use of external transformers and a watt transducer, or by direct connection to isolated contacts of a pulse initiating demand meter (The latter is generally provided by the local electric utility). The card labeled "DEMAND INPUT ANALOG" is designed to monitor the output of

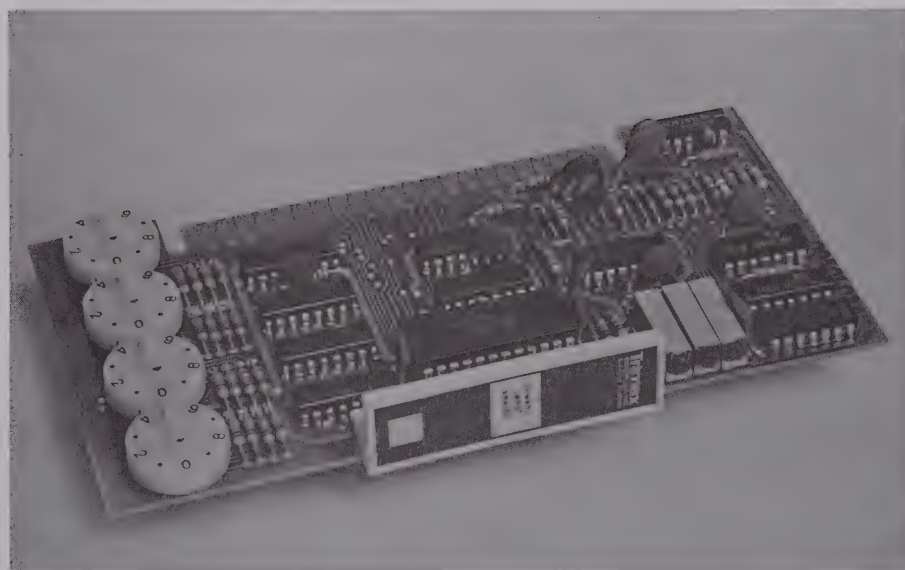
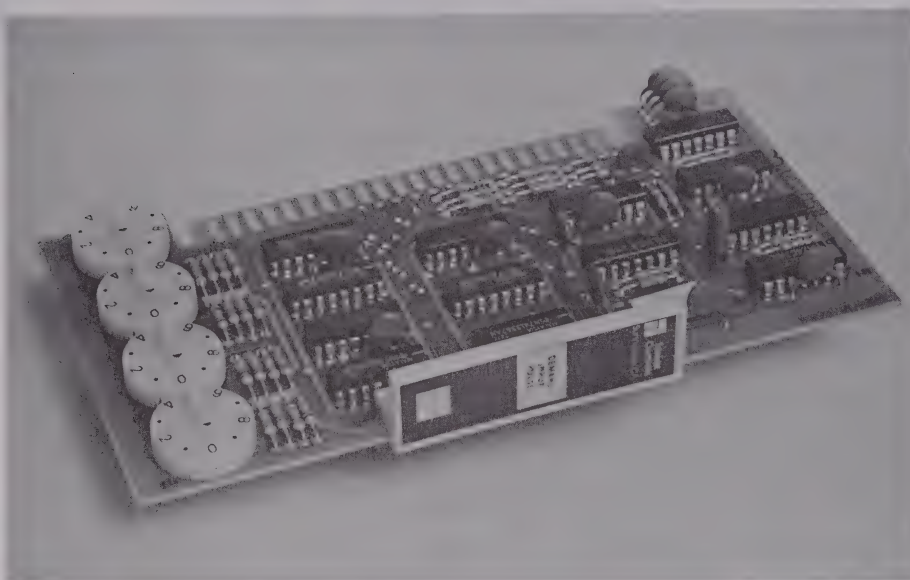


Figure 3.1: Demand Input Pulse and Analog Cards

a watt transducer and must be used only for that purpose. The option card labeled "DEMAND INPUT PULSE" is to be used for direct connection to the pulse initiating demand meter. The cards can be a mixture of pulse and analog cards as required. Regardless of the type of card selected, each will require setting of a correct scale factor into the 4 white rotary switches on the edge of the card. All slope and offset calibrations for the Demand Input Analog card have been preset at the factory during final test.

 CAUTION

Do not attempt to make slope or offset adjustments on the Demand Input Analog Card. Any user adjustments will result in incorrect measurement of facility demand.

On either the Analog or the Pulse Card, there are four switches, as shown in Figure 3.2. For the Analog Card, you must adjust these switches to set the value, in kilowatts, of a 1mA signal from your watt transducer. If consumption pulses are available from the demand meter, it will be necessary to set in the value of kilowatt hours per single pulse received by the Demand Input Pulse Card. This will generally be a value ranging from 0.01 to 10.00 KWH and must be obtained from the utility.

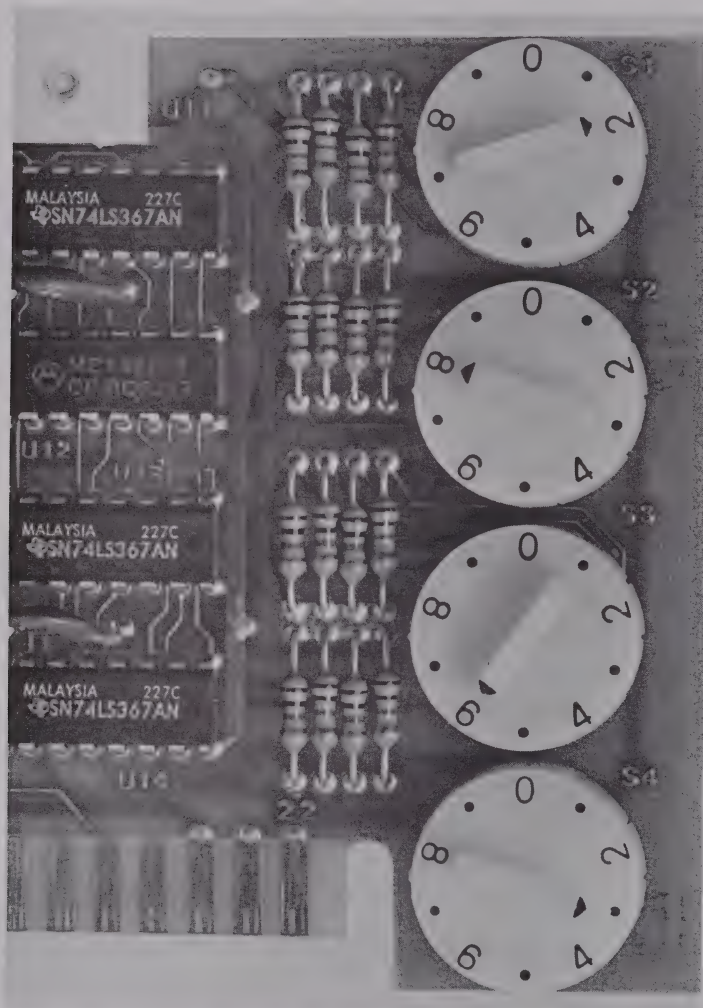


Figure 3.2: Switches on the Analog or Pulse Card

The first of these switches (S4) determines the exponential value (base 10) of the multiplier. The other three switches set the significant digits of the data. Setting these values is a lot less complicated than it sounds, since most people are quite familiar with the base 10 numbering system, the decimal system we use every day. But some readers may wish to use the next few paragraphs to refresh their memories.

We routinely understand the value of numbers by their position in relation to the decimal point. Thus, for example, the two in the number 2.0 has a much higher value than the two in the number 0.2; the value of the first two is higher by a factor of 10 ($.2 \times 10 = 2.0$). The two (2) is merely a symbol--its value is determined by its location in relation to the decimal point. Moving the decimal point one place to the right multiplies its value by 10; moving it two places to the right multiplies its value by 100 (10×10), and so forth. So the value of the digit two in the number 2000 is ten times greater than its value in the number of 200, and one hundred times greater than in 20 ($20 \times 10 \times 10 = 2000$).

Similarly, moving the decimal point one place to the left divides its value by 10, two places to the left divides its value by 100 (10×10), and so forth. Thus the value of the digit two in the number 2.0 is $1/10$ of its value in the number 20. And its value in the number .02 is $1/10$ of its value in the number .2. The

value of a digit to the left of the decimal point, then, can be calculated by determining how many times it is multiplied by 10. ($2000 = 2 \times 10 \times 10 \times 10$). The value of a digit to the right of the decimal point can be calculated by determining how many times it is divided by 10 ($.002 = 2 \times 1/10 \times 1/10 \times 1/10$).

For the sake of simplicity and convenience in dealing with larger numbers, the different values of a digit can be represented exponentially. Thus 2000, which is 2 multiplied by 10 three times, can be expressed as 2×10^3 (read as two times ten to the power of three). Similarly, 20,000 is 2×10^4 . In this case, then, the exponent of ten is 4, which simply means that the significant digit, in this case 2, is multiplied by 10 four times. Numbers less than 1, to the right of the decimal point are represented by negative exponents. Thus, .2 is 2 divided by 10 once. ($2 \times 1/10 = 2 \times 10^{-1}$), .002 is divided by 10 three times ($2 \times 1/10 \times 1/10 \times 1/10 = 2 \times 10^{-3}$), and so on. In this exponential system, the number one can be expressed as 10^0 (ten to the power of zero), for arbitrary reasons not relevant here.

There are various different ways to express a particular value in a base 10 system by the use of multipliers. For example, let us use the value of 4500 Kw.

$$4500 \times 1 = 4500 \text{ or } 4500 \times 10^0 = 4500$$

$$450 \times 10 = 4500 \text{ or } 450 \times 10^1 = 4500$$

$$45 \times 100 = 4500 \text{ or } 45 \times 10^2 = 4500$$

$$4.5 \times 1000 = 4500 \text{ or } 4.5 \times 10^3 = 4500$$

$$0.45 \times 10000 = 4500 \text{ or } 0.45 \times 10^4 = 4500$$

The four switches on the Demand Input Pulse Card and Demand Input Analog Card work in this manner. The setting of the exponential switch (S4) is determined by the exponent, or multiplier, required. The next three switches allow the user to enter the three most significant digits of the data value. Figure 3.3 shows the S4 position (POS), exponent (EXP), resulting multiplier (H), a sample data value (SWITCH DATA), and the resulting true value (VALUE).

Figure 3.4 shows three different ways to set switches S4 - S1 for a full scale value of 700 KW on the Demand Input Analog Card.

Note

After making any changes to the switch settings on either the Demand Input Analog Card or Demand Input Pulse Card, be sure to momentarily press the RESET button on the backside of the front door. The Model 830 will read the switch settings only after a power-up of the system or after pressing the RESET button.

Figure 3.3: Demand Input Card Switch Settings

Demand Input Analog Card

<u>POS.</u>	<u>EXP</u>	<u>M</u>	<u>SWITCH DATA</u>			<u>VALUE</u>
<u>S4</u>			<u>S3</u>	<u>S2</u>	<u>S1</u>	
0	2	100	4	5	0	45,000
1	1	10	4	5	0	4,500
2	0	1	4	5	0	450
3	-1	.1	4	5	0	45
4	-2	.01	4	5	0	4.5
5	-3	.001	4	5	0	0.45
6	-4	.0001	4	5	0	0.045

Demand Input Pulse Card

<u>POS</u>	<u>EXP</u>	<u>M</u>	<u>SWITCH DATA</u>			<u>VALUE</u>
<u>S4</u>			<u>S3</u>	<u>S2</u>	<u>S1</u>	
0	0	1	4	5	0	450
1	-1	.1	4	5	0	45
2	-2	.01	4	5	0	4.5
3	-3	.001	4	5	0	0.45
4	-4	.0001	4	5	0	0.045
5	-5	.00001	4	5	0	0.0045
6	-6	.000001	4	5	0	0.00045

NOTE: The number of the S4 switch position is not necessarily the same as the exponent. Any inadvertent confusion of the two numbers may cause a serious misreading of demand.

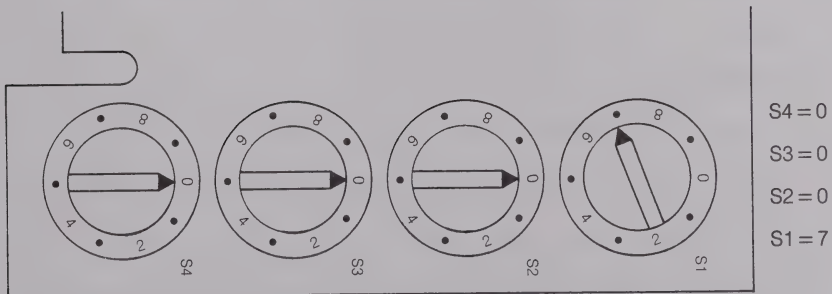
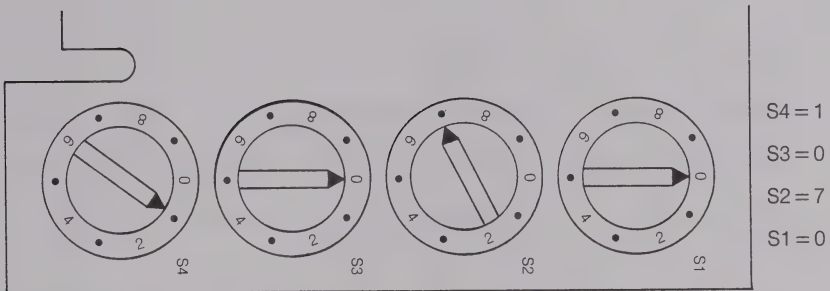
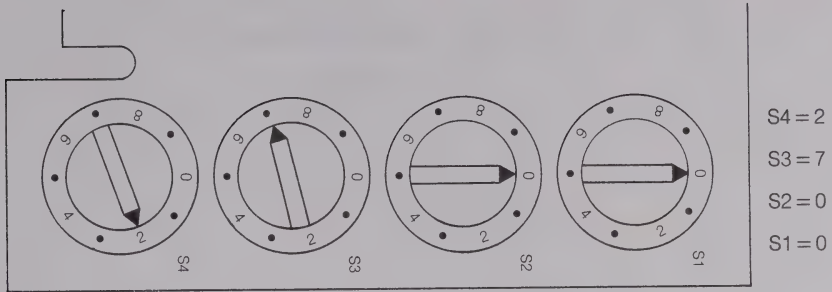


Figure 3.4: Three Different Switch Settings on Analog Card to Indicate 700kw Full Scale

3.1 Installation of Demand Control Option

Locate the sensor input connections, as described in Section 2.7 of this manual, in the upper right hand portion of the Model 830.

The slots labeled B through E are dedicated to the Demand Input Cards. As mentioned earlier, Trimax provides two different types of demand input cards, Analog and Pulse, which can be mixed within the four card slots.

The Demand Input Card can be placed in any of the slots. However, we recommend that you place your first demand input card in Slot B, your second in C, etc., for good organization.

After inserting the cards for the Demand Control Option, it is important to assure that the Powersense Configuration Switch Number 3 (the AUTOMATIC SETPOINT ADJUSTMENT switch) is in the desired position. The switch is located in a block of eight small white switches which are located on the backside of the door. Switch No. 3 is used to disable or

enable the self-adjusting setpoint feature and is used only with the Demand Control Option. In the OFF position (set to the left), the Powersense will not modify any setpoint values. The ON position (set to the right) turns on the automatic setpoint adjustment feature.

In the automatic setpoint ON position, the controller will readjust the setpoint value if any of the following situations occur:

- 1) Whenever a time period of 120 hours elapses with no load shed action taken for a particular setpoint, the setpoint value will be lowered by 5%;
- 2) Whenever an ALL CIRCUITS SHED condition exists for 15 minutes or more, the setpoint will be raised by 2%;
- 3) If the present demand value rises above the selected setpoint value, the present demand value automatically becomes the new value for the selected setpoint.

Here we will describe wiring for one demand input card of each type, placed in Slot B and wired to the row B terminal block. A second input for the Demand Input Card in Slot C would be wired to the row C terminal block, and so forth.

 CAUTION

The Model 830 supplies its own measurement voltage for purposes of detecting closures of the meter pulse contacts. DO NOT, UNDER ANY CIRCUMSTANCES, APPLY OR CONNECT ANY EXTERNAL VOLTAGE TO THE PULSE CONTACTS OR INPUT TERMINALS OF THE DEMAND INPUT PULSE CARD. Serious damage to the 830 may result which is not covered under the warranty.

 Note

When requesting installation of isolated pulse contacts in the existing demand meter, the utility may offer a choice of pulse closure rates. In all cases, ask for the fastest possible pulse rate (lowest KWH/pulse). The demand measurement accuracy of the Powersense 830 is significantly improved when faster pulse rates are used.

The Demand Input Pulse Card has one version for both Form A and Form C type meters. The card contains a removable small, blue plastic jumper labeled JU1 as shown in Figure 3.5. If you have a 3-wire (Form C) pulse initiating demand meter, all three wires should be used. This allows the integrity of the line to be detected by the 830. For a Form A (2-wire) pulse initiating demand meter arrangements, the jumper should be removed.

To wire a Form A pulse initiating demand meter, first remove jumper JU1 on the Demand Input Pulse Card. Run one wire to connection #3 of the B terminal block connector. Connect the second wire to connection #4. If you can identify the Common, it should be wired to connection #4 as shown in Figure 3.6.

To wire a Form C pulse initiating demand meter, do not remove jumper JU1 on the Demand Input Pulse Card. Run the Common (K) to connection #4 on the B terminal block. Connect the other two input lines (Y and Z) to connections #1 and #2 respectively, as shown in Figure 3.7.

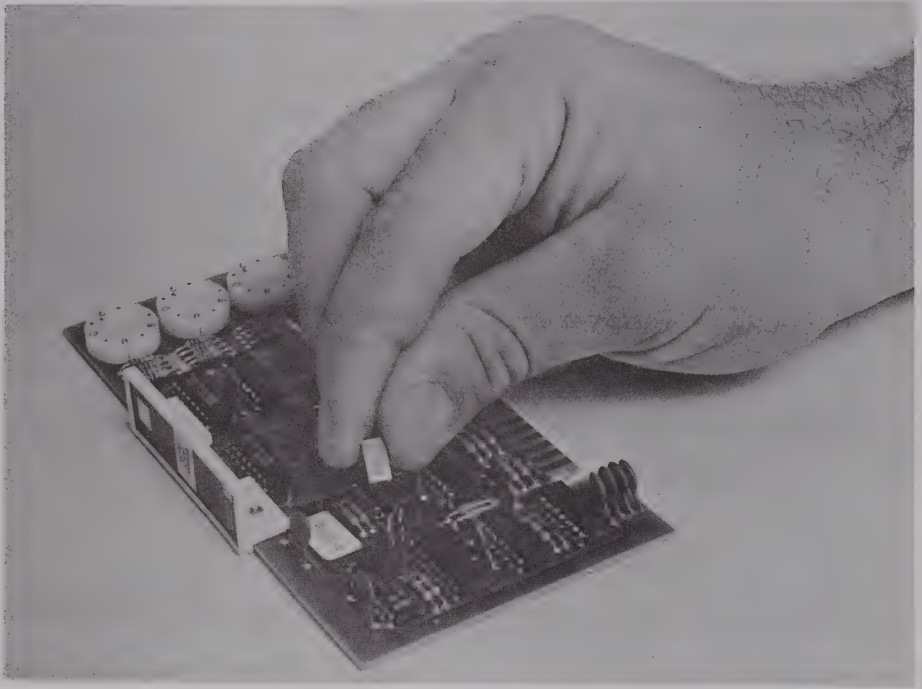


Figure 3.5: Removing Jumper on Demand Input Pulse Card

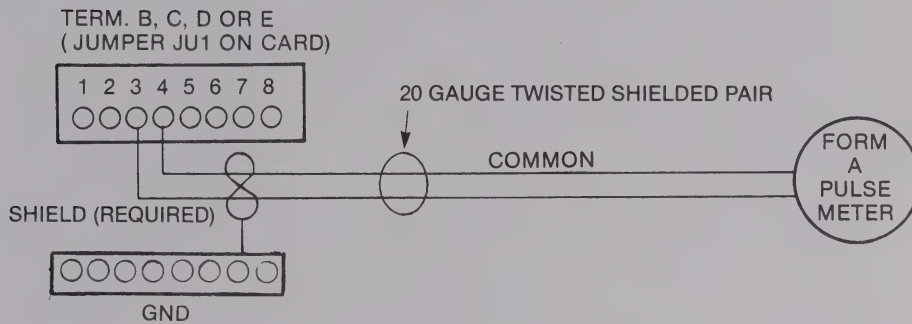


Figure 3.6: Wiring Pulse Initiating Demand Meter (form A)

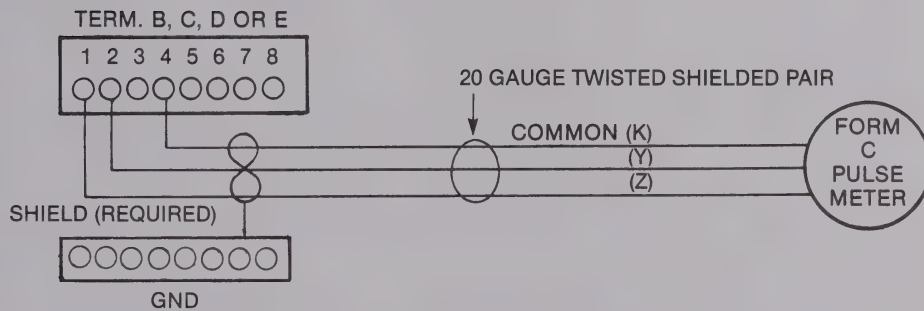


Figure 3.7: Wiring Pulse Initiating Demand Meter (form C)

 Note

Regardless of the type of pulse meter used (Form A or Form C), the use of shielded cable is absolutely mandatory in all installations. Reliable operation of the system is seriously jeopardized if shielded cable is not used for the entire run from the meter to the 830. Connect the shield to one of the ground terminals below terminal block P. Do not connect the other end; leave it floating.

To wire a Demand Input Analog Card (0-1 mA D.C. input signal into 5000 ohms), the source must be isolated (floating). Run the positive (+) from the watt transducer to connection #5 on terminal block B. Wire the negative (-) to connection #6, and ground the shield to one of the connections on the GND terminal block (below terminal block P). The other end of the shield should remain floating. See figure 3.8.

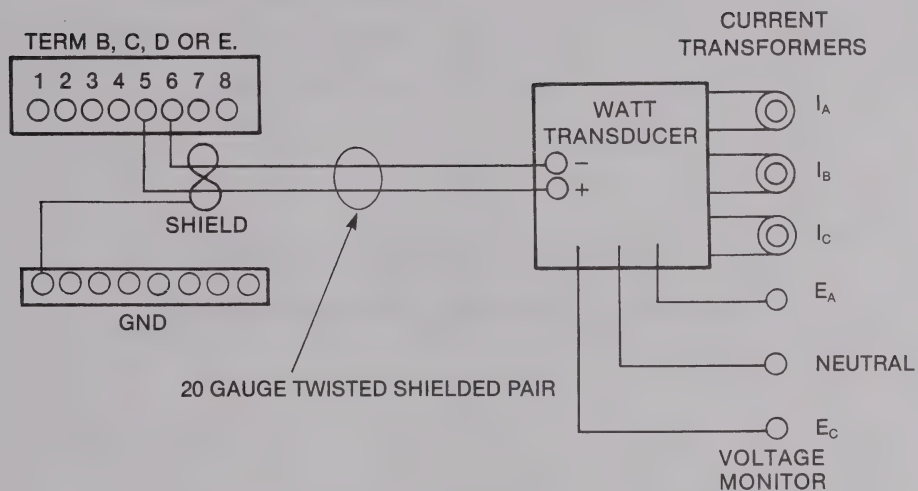


Figure 3.8 Wiring Analog Demand Meter Input
(208/120 VAC SERVICE ONLY)

 CAUTION

Input (sensor) cards should not be inserted or removed from the Model 830 without first switching off power to the unit or pressing the System RESET button while the change is made. Inserting or removing input cards with power applied may cause the microprocessor to lose its place and stop operating

**3.2 Installation of Current Transformers,
Potential Transformers, and Watt Transducer**

3.2.1 Monitoring Methods

The Powersense 830 is capable of measuring facility demand by direct connection to a pulse initiating demand meter or by analog measurement using current transformers and a watt transducer. The latter is generally more difficult to install and more expensive;

however, it will be the only method of measurement available if the utility company cannot or will not provide consumption pulses from the meter.

If consumption pulses are available, it is a simple task to wire the meter directly to the Model 830. The Model 830 will accept inputs from either a 2-wire or 3-wire pulse meter. Trimax encourages the use of all 3 lines if they are available. For accurate measurement, it is important to use shielded cable for the run from the meter to the 830. Ground the shield at the 830 end only; leave the meter end of the shield unconnected (floating). Be sure to set the scale factor switches on the Demand Input Pulse card to the meter pulse constant value supplied by the utility. Refer to the first section of this Chapter when setting these switches.

If consumption pulses are not available, facility demand can be measured by current transformers installed around the bus or cable at the service entrance. The Trimax Current Transformers (P/N 796-55 through 809-55) are split-core, voltage-limited (less than 50 VAC) and provide a 0-5 ampere output that is proportional to the current flowing through the bus or wire conductor. This continuous signal is then connected directly to the Trimax Watt

Transducer (P/N 762-09). One current transformer is required for each leg of the three phase service. The watt transducer also monitors the voltage on two of the phases for the purpose of calculating true kilowatts (amps x volts x power factor). The output of the watt transducer is a low voltage, low current DC signal that is then connected directly to the Model 830.

3.2.2 Determining Size of Current Transformers Required

In order to correctly size the current transformers, it will be necessary to determine the highest KW demand during the previous 12 months by examining utility bills. The current capacity is then calculated using the following formula:

$$I_{\max} = \frac{(P_{\max}) \times (1000)}{(E_{\text{leg-leg}}) \times (PF) \times (\sqrt{3})}$$

Where: P max is the maximum demand in kilowatts from the utility bills.

PF is the Power Factor (if unknown, use 0.85).

E leg-leg is the voltage across any 2 legs of the 3 phase service.

$\sqrt{3}$ is 1.732.

Example: Peak demand was 1192 KW in August. Voltage is 480; power factor is 0.866.

$$\begin{aligned} I_{\max} &= \frac{(1192) \times (1000)}{(480) \times (0.866) \times 1.732} \\ &= \frac{1,192,000}{719.958} \\ &= 1655.6 \text{ amps} \end{aligned}$$

It is prudent to allow 20% safety margin when selecting the current transformer. Therefore:

$$1655.6 \times 1.2 = 1986.7 \text{ amps}$$

Current transformers with the lowest available rating, yet still exceeding this figure should then be selected. In this example, a unit with a 2000:5 ratio (Trimax P/N 804-55) would then be the correct choice. A current of 2,000 amps flowing through the bus will produce a 5 amp output from the current transformer into the watt transducer. Note that a safety margin of 344.4 amps has been allowed for future expansion, growth, etc. In cases where future

growth may be significantly larger than 20%, it is wise to use the maximum rating of the service when calculating transformer size in order to avoid undersizing the current transformers. It is recommended, however, to also avoid deliberate oversizing of the current transformers as the accuracy of the transformer (thus the 830) is poor when operated only in a small portion of its total range (i.e, 0-10%).

3.2.3 Calculation of Full Scale Output From Watt Transducer

The watt transducer available from Trimax (P/N 762-09) is designed for installation on 3 phase, 4 wire, Wye services only. Consult the factory if you are attempting installation of the Trimax Watt Transducer on any other type of service. (see Figure 3.9)

The range of the transducer input current is 0-5 amps and nominal voltage is 120 VAC. The unit has been calibrated to provide a 1.0 ma DC output signal when 1.5 KW is measured at the input terminals of the watt transducer. Through the use of current transformers and potential transformers (if the service is greater than 208/120 VAC), this value can be multiplied to cover the operating range of

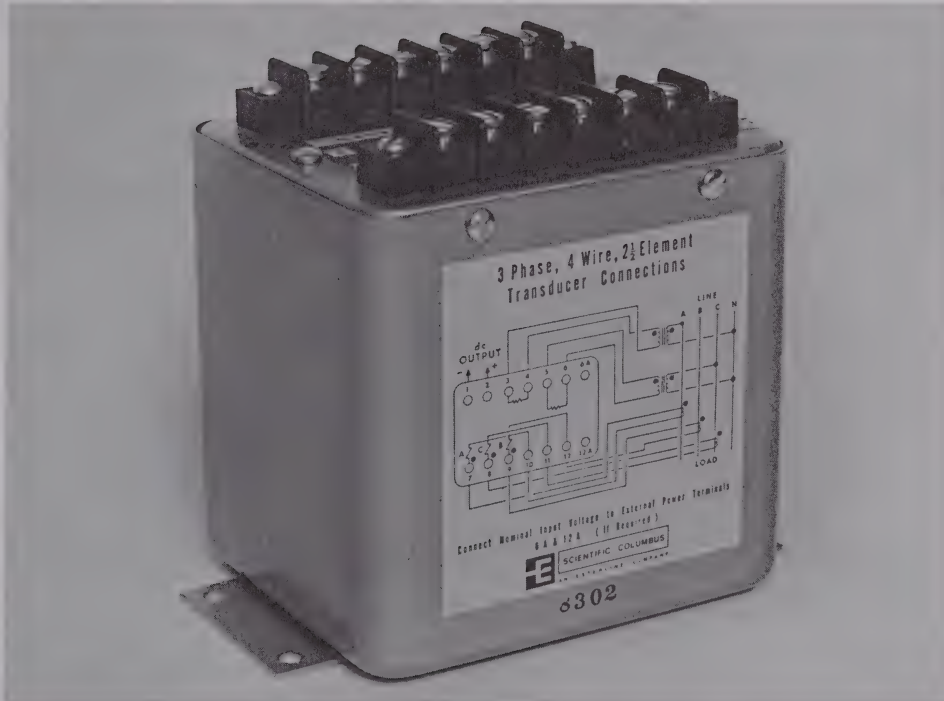


Figure 3.9: Watt Transducer

the facility. The formula for calculation of the KW value corresponding to a full scale (1 ma) output signal from the watt transducer is as follows:

$$P_{f.s.} = (1.5) \times (CTR) \times (PTR)$$

Where: $P_{f.s.}$ is the full scale Kw equivalent of 1 ma output signal.

1.5 is the calibration level of the watt transducer

CTR is the current transformer ratio

PTR is the potential transformer ratio (PTR = 1 if none installed)

The values of CTR and PTR are the turns ratio of the current and potential transformers, respectively.

Example: The value of CTR in the above example is equal to 2000:5 or 400. The value of PTR is 277 divided by 120 or 2.31

$$\begin{aligned} \text{Then } P_{f.s.} &= (1.5) \times (400) \times (2.31) \\ &= 1386 \text{ KW} \end{aligned}$$

In this example, the scale factor switches on the Demand Input Analog Card should be set to 1.39×10^3 as shown in section 3 of this manual.

3.2.4 Installation of Current Transformers

The Trimax Current Transformers are available with ratios of 300:5, 400:5, 500:5, 600:5, 800:5, 1000:5, 1200:5, 1500:5, 2000:5, 2500:5, 3000:5, 3500:5, 4000:5, and 5000:5. The 300:5 through 800:5 ratios are available with 4" (10.16 cm) circular openings. The 1000:5 through 4000:5 units are available with a 6" ID. The 5000:5 units are available in 8" configurations. All current transformers are the split, flexible core type that can be installed using a twisting motion to allow mounting on the bus or conductor. Figure 3.10

Read and follow all installation instructions supplied with the current transformers.

When installing the current transformers, power to the facility must be shut off. Remove the clamping screw from each transformer and position the unit around the bus or wire conductor, using a twisting motion only. The transformer should be positioned perpendicular to the conductor with the conductor centered in the transformer opening. Replace the screw and wing nut after correctly positioning the transformer.

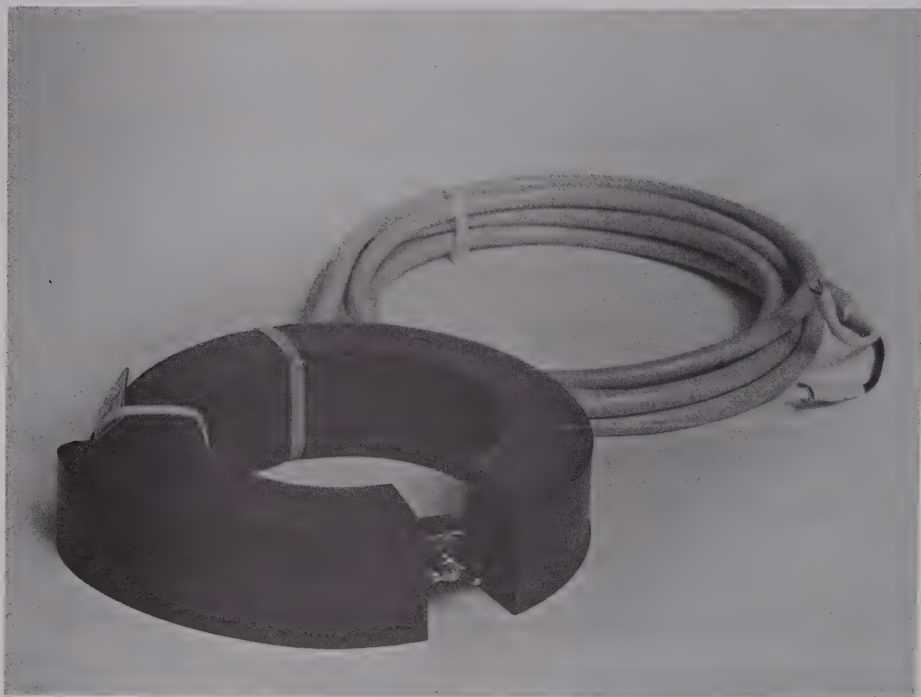


Figure 3.10: Current Transformer

 WARNING *

Do not attempt installation of the current transformers on any service that is greater than 600 volts.

Polarity is important. Connect the black wire (X1) of the current transformer to the appropriate input terminal marked with a polarity dot (.). Ensure that each transformer is oriented the same as the other two units and that all leads exit the transformer in the same direction. Make sure that the arrow labeled H1 on the transformer points toward the load and away from the service entrance.

 WARNING *

DO NOT RESTORE POWER TO THE FACILITY UNTIL THE CURRENT TRANSFORMER LEADS HAVE BEEN CORRECTLY (AND PERMANENTLY) CONNECTED TO THE WATT TRANSDUCER.

3.2.5 Installation of Potential Transformers

If the service voltage is 480/277 VAC, potential transformers will be required in order to step down the input voltage of 2 of the legs from 277V to 120V. If the service is 208/120V, the watt transducer can be connected directly to the service without the need for potential transformers. In either case, the measurement of voltage from each of the 2 legs to neutral should be routed through dedicated breakers of the smallest available current rating.

3.2.6 Installation of Watt Transducer

Mount the watt transducer within the range of the 12 foot leads from the current transformers. Do not splice in additional wire between the current transformers and watt transducer. Mount the transducer in a box or panel that is suitable for such purposes and meets all code requirements.

Wire the current transformers and potential transformers as shown in Figure 3.11. It is important to ensure that the current transformers and potential transformers are connected to the correct lines of the 3 phase (i.e., the potential transformer for leg A is connected to terminals 3 & 4 and the current transformer for leg A is connected to terminals 7 & 10). If the service is 208/120V, the potential transformers are not required and the transducer unit may be connected directly to the service. (In this case, terminals 3 and 6 may be tied together and connected directly to neutral.)

 Note

Polarity is critical to proper operation of the watt transducer and all polarity dots must be observed for proper operation.

The Trimax watt transducer is a self-powered unit that draws its input voltage from the voltage monitoring inputs, terminals 4 and 5. Therefore, no connection is required on terminals 6A and 12A. Use 20 gauge wire for the connection to terminals 1 and 2 and the run back to the model 830. This wire must have a 600 volt insulation rating as it is located in a box or panel where high

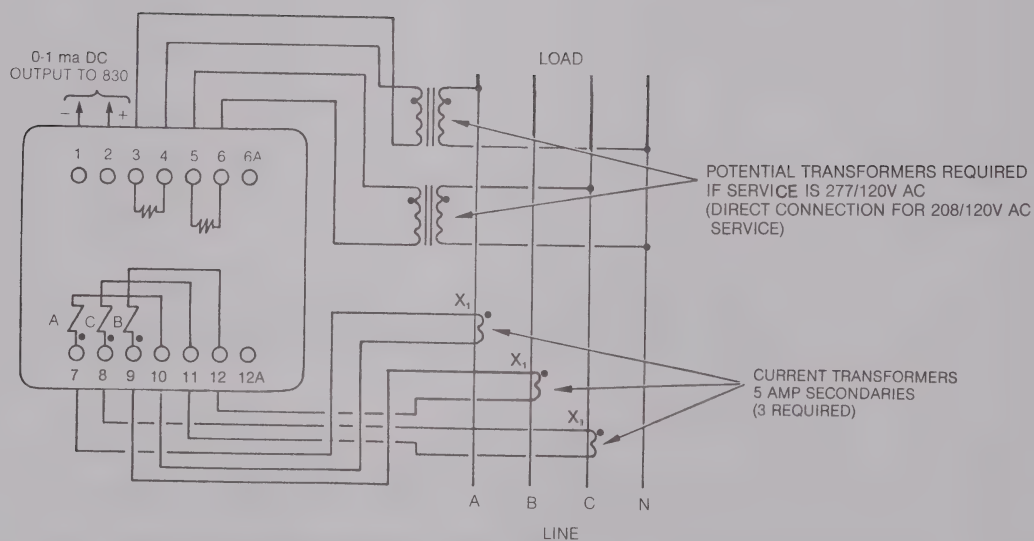


Figure 3.11: Wiring Connections for Watt Transducer, 3 Phase, 4 Wire, 2½ Element only.

voltages are present. It is recommended that shielded cable be used for the run from the watt transducer to the Model 830. Maximum run length is 1,000 ft (304 m) using 20 gauge wire. Ground the shield at the 830 end only; leave the end at the watt transducer unconnected (floating). Belden 8762 shielded cable or equivalent is ideal for this purpose. Make sure that the (+) and (-) lines are correctly connected at both ends.

3.3 Functions and Programming

This section of the manual will discuss the function keys, prompt lights and programming related to the Demand Control Option. In latter subsections of this section, the enter/change, check, and cancel programming sequences will be illustrated in step-by-step charts.

3.3.1 Function Keys

Before entering program data for the Demand Control Option, it is necessary to locate and understand the use of the function keys. On the front panel, locate the 16 function keys (as illustrated and described in Chapter 2, Section 2.9.4 of this manual).

SETPOINT functions to enter/change, check, and cancel the user entered setpoint value. (Note: With the Multiple Setpoint Option card installed, you may program up to five setpoint values, see Chapter VI, Multiple Setpoint Option.) After selecting the setpoint and deadband level, you will be prompted for the INTERVAL of the sliding window for averaging demand. While you can enter any value from 0 minutes to one hour, the rule of thumb is to use the same interval duration that your utility uses. Although intervals of less than 15 minutes are not yet in use, it is probable that utilities will adopt shorter intervals in the future. The shorter the timespan, the sharper the peaks and valleys in the present demand value displayed in the upper window.

PRIORITY is a function that allows you to assign each circuit to either priority shedding or rotating priority shedding. The fixed priority scheme, as shown in Figure 3.12, is a push down stack, which means generally, that the first load shed is the last one restored. In this priority routine, therefore, it is essential that you program your most deferrable loads to be shed first. Thus, your most critical load will be shed last and restored first under the fixed priority strategy. It is also possible, when loads are equal in importance, to arrange the loads in a rotating priority scheme in which the first load shed will be the first to

Figure 3.12: Fixed priority Sequence with 7 Circuits Installed (7th Unshed)

<u>Condition</u>	<u>Shed</u>	<u>Restore</u>
Shed	1	
Shed	2	
Shed	3	
Shed	4	
Restore		4
Shed	4	
Shed	5	
Restore		5
Restore		4
Shed	4	
Shed	5	
Shed	6	
Restore		6
Restore		5
Restore		4
Restore		3
Restore		2
Restore		1

be restored, as shown in Figure 3.13. With this arrangement, the load which has been off (shed) the longest will be the first restored when overall demand conditions in your facility permit.

Both priority schemes will be altered by the MIN/MAX times as mentioned above.

The Powersense 830 can accommodate fixed and rotating priority strategies at the same time. Using the combination of both creates a highly sophisticated single priority system as described below.

Deferrable loads are assigned to the fixed priority levels while non-deferrable, critical loads are assigned to the rotating priority levels. The designations of fixed priority levels range from 1-30, while the designations of the rotating priority levels range from 31-60. As you can see, the Powersense has 60 levels for a maximum of 30 circuits. This design enables you to place all of your circuits on either priority strategy. Or, you can place, for example, 5 deferrable loads into the fixed strategy and the remainder into the rotating strategy, etc. You must, however, remember to assign circuits which you want on fixed priority strategy to levels 30 or less, and those you want on rotating priority strategy to levels 31 or greater.

**Figure 3.13: Rotating Priority for the Same
830 Circuit Configuration**

<u>Condition</u>	<u>Shed</u>	<u>Restore</u>
Shed	1	
Shed	2	
Shed	3	
Shed	4	
Restore		1
Shed	5	
Shed	6	
Restore		2
Restore		3
Shed	7	
Shed	1	
Shed	2	
Restore		4
Restore		5
Restore		6
Restore		7
Restore		1
Restore		2

Note

The rotating priority scheme should not be construed as a cycling or "load-jog" feature. The rotating designation simply refers to the order in which loads are shed and restored. Under either the fixed or rotating strategy, the 830 will shed as many loads as necessary to achieve the setpoint entered.

It is more orderly to assign, for example, the first seven fixed priority circuits to levels 1-7, and the first seven rotating priority circuits to levels 31-37. Also, to protect circuits from being shed unintentionally, circuits not designated a priority level are assigned to level 0.

Note

Under either priority strategy (or a combination of both), all specified MIN/MAX conditions still take precedence.

Figure 3.14 shows a sample arrangement where 15 circuits are employed, 5 under fixed strategy and 7 under rotating strategy.

Figure 3.14: Combined priority Scheme Setup

<u>FIXED</u>		<u>ROTATING</u>	
<u>Level</u>	<u>Circuit</u>	<u>Level</u>	<u>Circuit</u>
1	10	31	1
2		32	11
3		33	
4	7	::	
5	15	::	
6	8	::	
:		40	6
:		41	5
:		42	4
		::	
		::	
		::	
15	3	46	9
		29	
		47	12
		48	

The Powersense scans through the fixed priority levels first to shed whatever deferrable loads it can before scanning the rotating priority levels or shedding any critical loads from that list. Thus, in the example given above (Figure 3.14), note that all loads on the fixed priority list were shed before the first load on the rotating priority list (Circuit 01). Similarly, when restoring loads, the unit will restore all possible loads on the Rotating priority list before restoring any of the deferrable loads on the fixed priority list. The MAX SHED and MIN ON times of the circuits which have them will affect the operation of this combined priority scheme. However, since the Powersense constantly scans the entire combined priority list (fixed and rotating), it will instantly detect a circuit returning to the list from MIN ON. Thus, if a fixed priority load returns while the 830 is shedding rotating loads, the unit will return to the fixed list to shed that load and will restore what it can of rotating priority loads.

The PEAK function allows you to check the peak demand which has actually occurred for a given setpoint. The demand peak in kilowatts is displayed in the top display window. The middle display gives you the date the peak occurred and the bottom window displays the time of occurrence. After this information is displayed, press NEXT to receive additional data; the top display

will then show the megawatt hours consumed to date from the last time the peak data was set to zero. The second and third displays will show the date and time that these values were last set to zero (0). Normally, these peak values should be cancelled (set to zero) only once a month, after the meter reading.

The ALARM function allows you to set an alarm level (in kilowatts) for each setpoint. The alarm level must be set below the maximum demand level for that setpoint to be effective. The Model 830 will then flash the alarm level light and sound the audible alarm as a warning that the demand has reached the alarm level.

3.3.2 Prompt Lights

Before entering information, locate the prompt lights on the front panel of the Powersense 830 that are listed below. It is important to have a good understanding of their use and operation before attempting to enter program data.

KILOWATTS -- This prompt requests the maximum demand level for the facility in kilowatts. When lit, the unit will accept a value in the range of 1 to 9999. With the maximum demand level entered, the Model 830 will automatically shed loads to maintain facility demand below this level.

DEADBAND -- When lit, this requests an offset value (also in kilowatts) to establish the deadband region. This value is subtracted from the setpoint level, which was entered in response to the KILOWATT prompt. If the predicted and present demand values drop below the deadband region, loads that are shed will be restored. A good rule of thumb to follow in setting the deadband value is to use 150% of your largest sheddable load. If your setpoint is 750 KW and your largest sheddable load is 30 KW, an appropriate deadband value would be 45 KW. Loads will be then be restored when the present demand drops below 705 KW. The deadband provides protection against a phenomenon called "hunting". This occurs when the deadband value entered is too small and the largest sheddable load is larger than the deadband. If this is the case, the 830 will shed a load in a critical demand situation and acknowledge that the demand has dropped below the deadband region. The load will then be restored, pushing the demand above the setpoint, then shed again, and so on. Hunting can be prevented by selecting a deadband value that is 50% greater than your largest sheddable load.

INTERVAL -- This prompt light specifies the width in time of the sliding window (see Chapter 1, "History of Demand Charges"). The value in minutes is the time period over which the running average for present demand is maintained. This prompt light requests that

you enter a value in minutes between 0 to 59, or the designation 100 for 1 hour. A value from 60 to 99 will cause the error indicator to light. When first powered on, the Powersense 830 assumes a default interval value of 15 minutes.

MIN SHED, MAX SHED, MIN ON -- These prompt lights request a time value in hours and minutes, in a range from 0 minutes to 12 hours and 59 minutes (0 to 1259). In your priority scheme, you may schedule critical loads with a minimum shed time, a maximum time the load can be shed, and a minimum on time. MIN ON sets the minimum amount of time that the load, once restored, must remain ON. MAX SHED is the most crucial factor because it prevents critical equipment from being out of service for inordinate periods of time. Combined with MIN ON, you can program the priority of a load, for example, so that it can be shed for no more than 5 minutes, and when restored, it must run for a minimum of 45 minutes. This capability is useful for refrigeration loads.

3.3.3 Programming Setpoint

The selection of the setpoint value is important to the overall savings in utility billing. A setpoint that is too high will result in unnecessary demand charges, while a low setpoint will cause excessive shedding and possible discomfort to building occupants.

A reasonable approach to selecting the setpoint is to first review the electrical utility bills for the previous 12-18 months. Identify the month that reflects the highest demand reading during that period. A realistic target for demand reduction is 20% of the highest value. The setpoint would then be 80% of the demand peak during the last 12-18 months. For example, if your demand peak during that period was 653 KW, the appropriate starting setpoint should be 0.8×653 or 522 KW. This value may have to be revised upward or downward depending on the response of the 830 and the facility.

The deadband value selected should be in the range of 75%-150% of the largest sheddable load. For averaging intervals of less than 15 minutes, the deadband should be 150% of the largest sheddable load. Averaging intervals of 15 minutes or more will allow

smaller deadband values. Larger deadband values will cause the 830 to perform demand control in a more aggressive manner (i.e., loads will be shed earlier and restored later for larger deadband values).

The averaging interval should conform to the interval that is in use by your utility. The Model 830 uses a sliding interval type algorithm to monitor demand. If your utility uses a fixed interval method of demand measurement, you should use the length in minutes of each fixed interval. Selection of an interval shorter than that in use by the utility will result in more rapid and frequent shedding and restoration of loads. Use of an interval longer than that used by the facility is specifically not recommended, as the utility demand meter may then register a higher demand than that observed by the Model 830.

Use the following charts to enter/change, check, and cancel the Setpoint, Deadband and Interval values:

Enter/Change Setpoint, Deadband, and Interval

STEP	USER ACTION	PROMPT
1	Position RUN/CHANGE switch to CHANGE	
2	Press SETPOINT	NUMBER*
3*	Enter a single digit number between 1-5 for the Setpoint desired. The corresponding indicator will light.	SETPOINT
4	Enter the Setpoint value in kilowatts from 2-9999. This will appear in the upper display window.	
5	Press NEXT	DEADBAND
6	Enter the Deadband value in kilowatts from 1-2500. Must be lower than the setpoint in step 4. The deadband value will appear in the middle display window.	
7	Press NEXT	INTERVAL
8	Enter the duration of the average interval in the range of 0-59 minutes, 100 for one hour. This will appear in the lower display window.	
10	Press NEXT	ENTER
11	Press ENTER	
12	Position RUN/CHANGE switch to RUN	

* Only if Multiple Setpoint Option is installed

Check Setpoint, Deadband, and Interval

STEP	USER ACTION	PROMPT
1	Press CHECK	
2	Press SETPOINT	NUMBER*
3*	Enter Setpoint number (1-5).	
4	The stored value for that setpoint is displayed in the upper window; Deadband in the middle window; Interval in the lower window.	NUMBER**
5	Press CLEAR twice to leave the schedule check mode.	

* Only if Multiple Setpoint Option is installed.

** Number prompt will remain lit after step 3 to allow you to check additional setpoints (if Multiple Setpoint Option is installed).

Cancel Setpoint, Deadband, and Interval

STEP	USER ACTION	PROMPT
1	Position RUN/CHANGE switch to CHANGE	
2	Press SETPOINT	NUMBER*
3*	Enter Setpoint number (1-5)	KILOWATTS
4	Press CANCEL	ENTER
5	Press ENTER	
6	Position RUN/CHANGE switch to RUN	

* Only if Multiple Setpoint Option is installed

3.3.4 Programming Priority

As you determine your priority scheme, be sure to assign your most deferrable loads (e.g., hot water heaters, battery chargers, etc.) to the lower numbers (1-30), on the fixed priority schedule. Air conditioning, while deferrable, is frequently important to the operation of the facility. As such, it should be placed on the rotating priority (31-60).

Now, apply the procedures in the following programming charts to enter/change, check, and cancel priorities:

Enter/Change Priorities

STEP	USER ACTION	PROMPT
1	Position RUN/CHANGE switch to CHANGE	CIRCUIT(S) NUMBER
2	Press PRIORITY	
3	Enter 2-digit circuit number.	
4	Enter a 2-digit priority number from 00 to 60. 00=Load never available for shedding 01-30=Fixed priority schedule 31-60=Rotating priority schedule	
	Note: No circuit can be assigned more than one priority or the same priority as another circuit.	ENTER
5	Press ENTER	
6	Position RUN/CHANGE switch to RUN	

Check Shed/Restore Priorities

STEP	USER ACTION	PROMPT
1	Press CHECK	CIRCUIT(S)
2	Press PRIORITY	
3	Enter circuit number. This number will appear in the upper display window with its priority displayed in the middle window.	
4	Press CLEAR twice to return to normal operations.	CIRCUIT(S)**

** Circuit(s) prompt will remain lit after step 3 to allow you to check additional circuits by repeating step 3.

Cancel Priorities

STEP	USER ACTION	PROMPT
1	Position RUN/CHANGE switch to CHANGE	CIRCUIT(S) NUMBER ENTER
2	Press PRIORITY	
3	Enter circuit number.	
4	Press CANCEL	
5	Press ENTER . The circuit is assigned a priority of zero (00).	
6	Position RUN/CHANGE switch to RUN	

3.3.5 Programming Peak Demand Value

The Powersense 830 retains the highest Demand Peak observed. The user cannot change the peak demand value except by setting it to zero (0). Once this is done, new values will be recorded along with the time and date of occurrence.

Note

When first powering up the Powersense 830, it is advisable to set the peak value to zero after setting the clock. Otherwise, the time and date of the last reset will be stored as 12:02 a.m., Jan. 1, 1980.

To reset and check the Peak Demand Value, follow the procedures listed in the programming charts:

Setting Peak Demand Values to Zero

The Powersense 830 retains and updates the highest (peak) demand level observed. The user cannot change the Peak Demand Value except by resetting it to zero (0). Once reset, new values will be recorded along with the time and date of occurrence.

STEP	USER ACTION	PROMPT
1	Position RUN/CHANGE switch to CHANGE	(—NOCL—) ENTER
2	Press PEAK	
3	Press CANCEL	
4	Press ENTER	
5	Position RUN/CHANGE switch to RUN	

Note: When first powering up, it is advisable to reset the peak value after setting the clock. Otherwise, the time and date of the last reset will be stored as 12:02 am, Jan. 1, 1980.

Check Peak Demand Values

STEP	USER ACTION	PROMPT
1	Press CHECK	NUMBER*
2	Press PEAK	
3*	Enter setpoint number (1-5).	
4	The demand peak will appear in the upper display window; the date of occurrence is in the middle display window; the time of occurrence is in the lower window.	
5	Press NEXT Upper display will show the total megawatt hours consumed since the last reset; the middle and lower windows will show the date and time of the last reset.	
6	Press CLEAR twice.	

* Only if Multiple Setpoint Option is installed.

3.3.6 Programming Alarm Level

Use the programming charts in this section to enter/change, check, and cancel Alarm Levels:

Enter/Change Alarm Level

STEP	USER ACTION	PROMPT
1	Position RUN/CHANGE switch to CHANGE	NUMBER*
2	Press ALARM LVL	
3*	Enter setpoint number (1-5). Corresponding setpoint selected indicator will light.	
4	Enter the value in KW for the alarm level within a range of 1-9999.	KILOWATTS
5	Press NEXT	ENTER
6	Press ENTER	
7	Position RUN/CHANGE switch to RUN	

* Only if Multiple Setpoint Option is installed.

Check Alarm Level

STEP	USER ACTION	PROMPT
1	Press CHECK	NUMBER*
2	Press ALARM LVL	
3*	Enter setpoint number (1-5).	
4	The stored alarm level will be displayed in the upper window.	
5	Other levels can be checked by entering other setpoint numbers.*	
6	Press CLEAR twice to restore normal front panel operations.	

* Only if Multiple Setpoint Option is installed.

Cancel Alarm Levels

STEP	USER ACTION	PROMPT
1	Position RUN/CHANGE switch to CHANGE	NUMBER * KILOWATTS ENTER
2	Press ALARM LVL	
3*	Enter setpoint number (1-5)	
4	Press CANCEL	
5	Press ENTER	
6	Position RUN/CHANGE switch to RUN	

* Only if Multiple Setpoint Option is installed.

IV Temperature Input Option

In many instances the complete energy management function will require measurement and monitoring of temperatures in order to maximize energy savings while maintaining comfort loads within the facility. The Temperature Input Option (Figure 4.1) of the Powersense 830 performs 3 temperature related energy management functions as follows:

- 1) Self tuning optimal start of heating and/or cooling loads with setback control during off hours;
- 2) Temperature compensated duty cycling based on indoor or outdoor temperature;
- 3) Temperature compensation of the demand setpoint based on outdoor temperature.

Temperatures may also be reviewed via the front panel as well as the serial communications option, if installed.

The Powersense 830 is capable of accepting two Temperature Input Option Cards. Each card can be connected to four remote sensors.

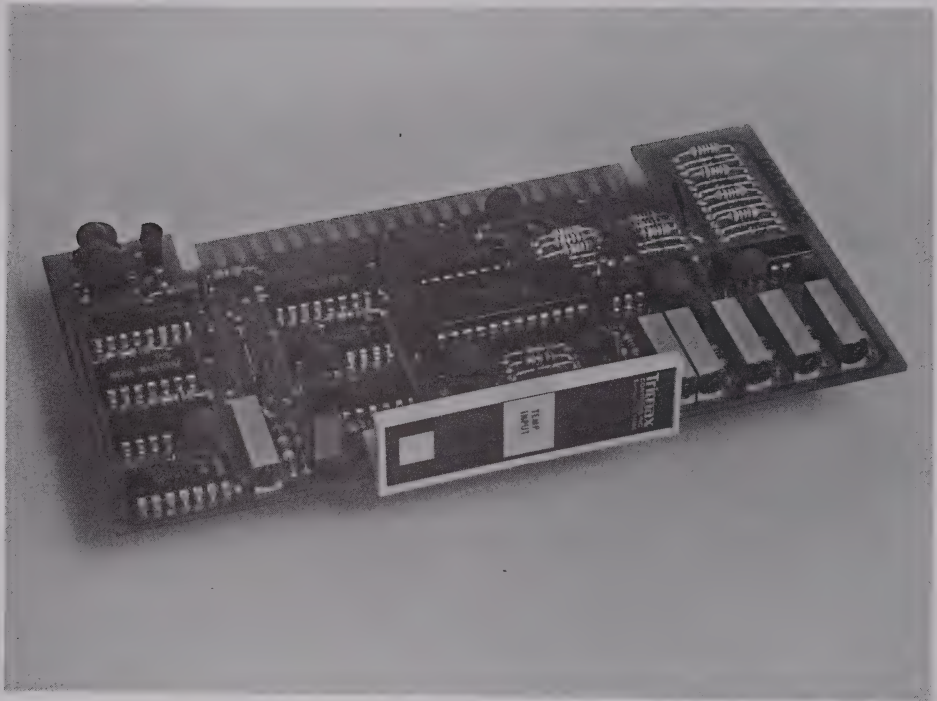


Figure 4.1: Temperature Input Option Card

It is required that the first sensor input on the first card be used for the outdoor sensor. The temperature sensors are available for outdoor use (Figure 4.2) or indoor use (Figure 4.3).

4.1 Installation of the Temperature Input Cards

SLOTS J and K are dedicated for the Temperature Input Cards. If only one card is to be used, it should be inserted into slot J. The inputs are wired to the odd numbered connections and the returns are wired to the even numbered connections of the terminal blocks corresponding to the slot (either J or K). It is important that the Zone 1 inputs (terminal block J, connections #1 and #2) be connected to the outdoor temperature sensor as Zone 1 is used by the optimal start function. Refer to Figure 4.4 for temperature sensor wiring.

CAUTION

Input (sensor) cards should not be inserted or removed from the Model 830 without first shutting off power to the unit or pressing the System RESET button while the

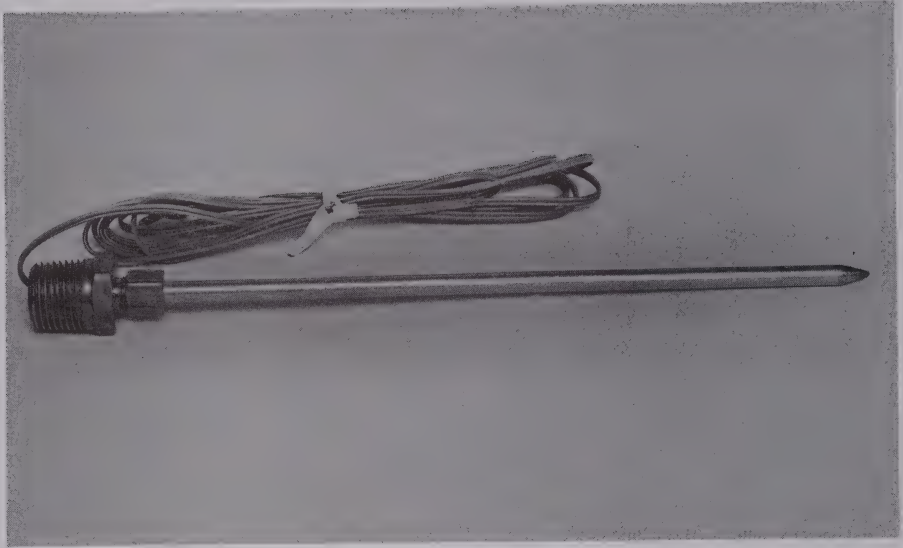


Figure 4.2: Outdoor Temperature Sensor

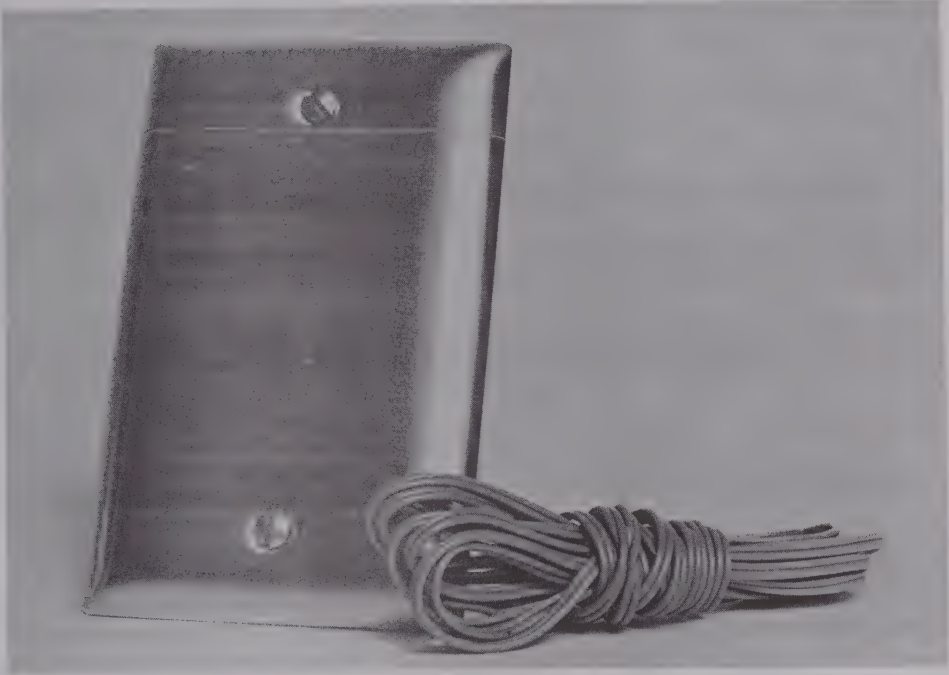


Figure 4.3: Indoor Temperature Sensor

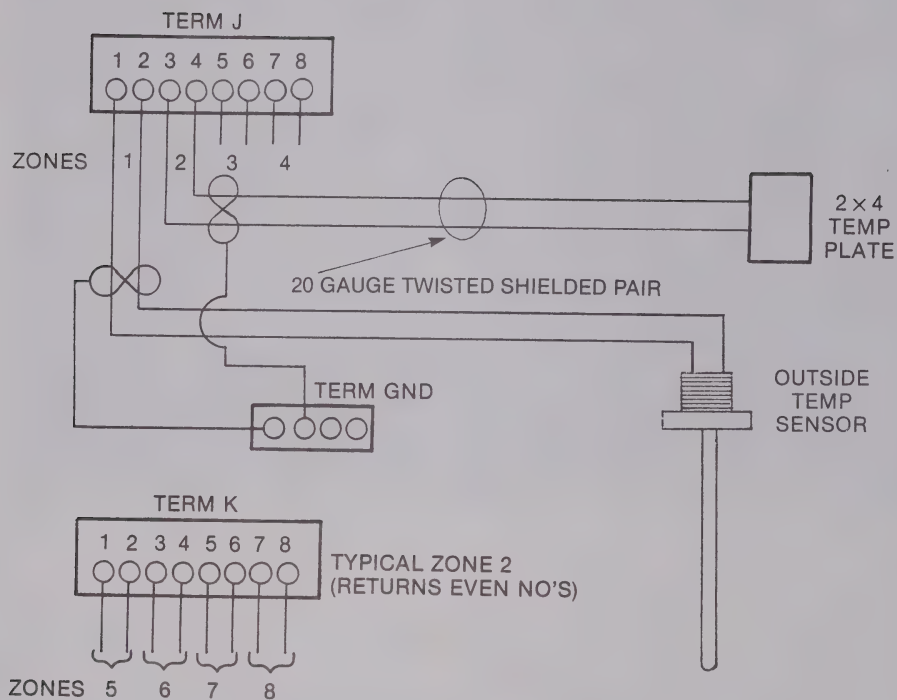


Figure 4.4: Wiring Temperature Input Sensors

change is made. Inserting or removing input cards with power applied may cause the microprocessor to lose its place and stop operating.

4.2 Installation of Temperature Sensors

The Trimax indoor temperature sensor (P/N 738-39) and outdoor sensor (P/N 739-39) are thermistor based sensors encased in appropriate mounting hardware for ease of installation. The thermistor element is a resistor with a high temperature coefficient of resistance that is a direct function of absolute temperature. The Model 830 measures this resistance by applying a small voltage to the element and converting the voltage received into a temperature value.

4.2.1 Wiring

Both types of sensors are supplied with 8 foot (2.4 meter) leads of 2 conductor, 22 gauge gray zip cord. The wiring from the sensor to the 830 should be 18 to 22 gauge, however, shielded

cable of a type similar to Belden 8762 (two 20 gauge stranded and twisted conductors with shield) is strongly recommended. The use of shielded cable will prevent induced A.C.voltage from appearing on the temperature lines as well as shielding from transient spikes. The shield should be grounded at the 830 on the terminals marked "GND" and left floating (unconnected) at the sensor end.

WARNING ★

If temperature sensor wiring must be run in the same conduit, tray, or trough with high voltage wiring (120 VAC and up), the use of shielded cable is absolutely necessary to insure accurate temperature readings.

The high sensor resistance and large change in resistance per degree F allows for the use of 22 gauge copper wire in almost all installations. The chart below shows the maximum run length of wire between sensor and 830 that will result in a maximum possible error of 1/2 degree F.

<u>Wire Size</u>	<u>Max. Run Length in Feet (Meters)</u>
22 ga.	7,800 (2,377)
18 ga.	19,500 (5,943)
16 ga.	31,250 (9,525)
14 ga.	50,000 (15,240)

 WARNING

Connection of the sensor to any voltage source other than the Model 830 sensor input connections can cause irreversible damage that is not covered by the Powersense 830 warranty. The resistance can be checked with a Volt-Ohm-Meter (VOM) without harm. A reading of 10,000 ohms at 77° F is normal. If line voltage is accidentally applied, replace the unit as its accuracy will have been destroyed.

Solder connections for splicing sensor leads to the shielded cable are more reliable and strongly recommended. Crimp-type butt splices are the second choice and usually prove satisfactory if located indoors. Simple wire nut connectors are an invitation to long term trouble.

The zip cord sensor leads are rated at 220° F (105° C) and should be routed away from heat strips, duct and plenum heaters, etc.

4.2.2 Mounting Indoor Sensor

The indoor sensor is a blank plate designed for surface mounting using a standard 2x4 electrical box. The sensor should be mounted only in interior areas with a temperature range from 40° to 100° F (4° - 38°C). The sensor plate has an insulated back that eliminates conductive influence of wall temperature yet allows significant convective influences to be sensed with a dampened response.

Mount the sensor on an interior wall at light switch level near a return air grill. Select a location nearest the mid-point of the conditioned area. Do not mount the sensor in dead air spaces, in or near supply air streams, or on exterior walls. Be especially careful to avoid locations that receive direct sunlight exposure at any time during the year. Also avoid locations near equipment that is a source of heat or cold such as transformers, office machines, water coolers, refrigerated food cases, outside doors, or doors to unconditioned spaces.

Mount the sensor using the screws supplied. Tighten mounting screws, crushing foam gasketing, until the edges of the plate just touch the wall.

4.2.3 Mounting Outdoor Sensor

The outdoor sensor consists of a 9 inch (22.8 cm) long stainless steel tube with a brass electrical fitting. The probe is waterproof and may be mounted in any environment having a temperature range from -30° to $+300^{\circ}$ F. Note, however, that the Model 830 provides accurate temperature readings in the range of from -10° to $+110^{\circ}$ F.

The probe may also be used to sense temperature in indoor/outdoor ducts as well as return air plenums. Follow the mounting instructions enclosed with the sensor if plenum/duct temperature measurement is desired.



For sensing outside ambient temperature, the sensor must be mounted vertically on a wall or surface that has a north exposure. For accurate temperature readings, the sensor must not receive direct sunlight at any time. Mounting the probe anywhere on or above the roof will generally result in erroneously high outdoor temperature readings.

Select a location that has good exposure to air movement and is not located in dead space. The sensor should be screwed directly into type LB 1/2" conduit (remove and discard locknuts supplied with the sensor). The conduit should then be mounted securely with the sensor probe pointing downward and conduit run inside the building.

4.3 Functions and Programming

This section of the manual will discuss the function keys, prompt lights, and programming related to the Temperature Input Option. In later subsections, the enter/change, check, and cancel programming sequences will be explained for OPTIMAL START, TEMPERATURE COMPENSATED DUTY CYCLE, and TEMPERATURE COMPENSATED SETPOINT.

4.3.1 Function Keys

Before entering program data, it is necessary to locate and understand the use of the function keys related to the Temperature Input Option.

The OPT START function is designed to switch ON heating or cooling equipment at precisely the right time to provide the desired temperature of the facility when it is occupied (OCCUP TEMP), and it will vary that starting time as a function of indoor and outdoor temperature. The OPT START feature also maintains a SETBACK TEMP, a higher summer or lower winter temperature at which the facility is to be kept when it is not occupied. Since conditions vary and facilities differ in their heat-up/cool-down characteristics, most other systems on the market require constant operator adjustment to maintain maximum efficiency. The Powersense 830 is unique in that it maintains a facility profile in its memory and constantly adjusts itself. You must designate a zone for optimal start as a single digit number, in the range of 2-8.

TEMP COMP DUTY CYCLE allows the 830 to be programmed with an aggressive duty cycle pattern (via the DUTY CYCLE key) and then compensate the pattern whenever the assigned temperature zone reading falls outside a specified range. When the duty cycle pattern is compensated due to temperature, the 830 extends the ON duration by a calculated amount and shortens the OFF duration by the same number of minutes. The total of the ON plus OFF durations never changes, regardless of the amount of compensation taking place.

The TEMP function allows you to check the current temperature of any zone, including the outdoor temperature. The Temperature will appear in the upper display window. This function can be used only for checking information and not to enter/change or cancel a temperature value.

TEMP COMP SETPOINT operates in a manner similar to TEMP COMP DUTY CYCLE. In this case, the function adjusts the value of a selected setpoint up or down as a function of ambient outdoor air temperature.

4.3.2 Prompt Lights

The prompt lights listed in this section will aid in programming the Temperature Input functions. Locate the lights on the front panel of the unit.

KW/DEG -- This prompt light requests a number of kilowatts variance per degree of outside temperature initiated by the TEMP COMP SETPOINT sequence (4.3.6 of this manual). On days of extreme temperature, you may wish to vary the normal setpoint to allow the facility to use more heating on very cold days or air conditioning

on very hot days. Using the outside temperature sensor and a base (target) temperature value, the setpoint will be varied by "n" amount of kilowatts for every degree above or below the base temperature. The "n" value in kilowatts is what the 830 expects you to enter when this prompt is lit. The value can range between 1-200 (per degree).

SETBACK TEMP -- This light requests that you enter a temperature at which you wish the building to be kept when it is not occupied. This prompt is used during the OPT START sequence. The value to be entered must be between 0° - 120°F.

OCCUP TEMP -- This requests the desired building temperature during working hours. This prompt comes on after the setback temperature has been entered during the optimal start sequence.

MIN/DEG -- In response to the TEMP COMP DUTY CYCLE function, this prompt allows you to enter the amount of time (ranging from 1 minute to 1 hour) that the 830 will adjust the ON portion of the duty cycle pattern per degree above or below the base indoor or outdoor temperature.

BASE TEMPERATURE -- With this prompt, the Powersense 830 requests entry of a reference temperature that it will use for variance of either the duty cycle ON time or the value of a setpoint in kilowatts.

4.3.3 Programming Optimal Start

The Powersense 830 derives its "target time" for having the facility at temperature from schedule No. 1 of the primary circuit. (The first circuit number entered in response to the CIRCUIT(S) prompt when programming OPT START). In this manner, the Powersense 830 has five immediate pieces of data from which to base its calculations: (1) the setback temperature, (2) the occupied temperature it is programmed to achieve, (3) the time when OCCUP TEMP is to be achieved, (4) the outside ambient air temperature, and (5) indoor air temperature.

CAUTION

The optimal start function of the 830 operates in series with the existing thermostats in the facility. It is crucial that for heating the OCCUP TEMP is set 4 degrees lower than the building thermostat. The Model 830 times how long it takes to reach the OCCUP TEMP and uses this time value for the self-adjusting and future calculations. If the thermostat is set to a lower temperature than the 830, the thermostat will switch

OFF heating equipment before the building reaches the target temperature, and its calculations will become erroneous. Similarly, for cooling the OCCUP TEMP should be set 4 degrees warmer than the thermostat.

As the 830 requires an initial period of time in order to build a data base of early start increments, it is prudent to allow a "cushion" period in the morning between the programmed start time for the circuit and the actual start of business. This allows for conditions where the Model 830 may not have initially selected an early start increment that brings the building to the desired occupied temperature by the desired start time. Once the unit has "learned" the characteristics of the building, the scheduled ON times may be changed to conform more closely to the actual hours of facility operation

Also, when programming the optimal start feature, remember that the 830 performs thermostat control only for the setback temperature during the period of time that the circuit is scheduled OFF. During normal scheduled ON periods, the circuit is treated as any other circuit and does not switch ON and OFF to maintain the occupied temperature.

Now follow the programming instructions below to enter/change, check, and cancel OPT START data:

Enter/Change Optimal Start Data

STEP	USER ACTION	PROMPT
1	Position RUN/CHANGE switch to CHANGE	ZONE CIRCUIT(S)
2	Press OPT START	
3	Enter zone number in the range of 2 - 8.	
4	Enter 2-digit number of primary circuit (circuit number whose time is to be used as target). Circuit number will appear in the upper display window.	CIRCUIT(S)
5	(Optional) Enter additional circuit numbers if desired for circuits to be optimally started.	
6	Press NEXT	SETEACK TEMP
7	Enter setback temperature in the range of 0 to 120 Deg F.	OCCUPIED TEMP
8	Press NEXT	
9	Enter occupied temperature in the range of 0 to 120 Deg F.	ENTER
10	Press NEXT	
11	Press ENTER	
12	Position RUN/CHANGE switch to RUN	

Check Optimal Start Data

STEP	USER ACTION	PROMPT
1	Press CHECK	ZONE
2	Press OPT START	
3	Enter zone number in the range of 2 - 8. Upper window will display primary circuit number for heating, center window will show heating setback temperature, lower window will display heating occupied temp. Circuits to be controlled under heating optimal start for this zone will have ON status indicators lit.	
4	Press NEXT the upper window will display primary circuit number for cooling, center window will show cooling set-up temperature, and the lower window will display cooling occupied temperature. Circuits to be controlled under cooling optimal start for this zone will have ON status indicators lit.	ZONE
5	Enter additional zone numbers to check optimal start data for other zones.	ZONE
6	Press CLEAR twice when finished.	

Cancel Optimal Start Data

STEP	USER ACTION	PROMPT
1	Position RUN/CHANGE switch to CHANGE	ZONE CIRCUIT(S) ENTER
2	Press OPT START	
3	Enter zone number in the range of 2 - 8.	
4	Press CANCEL	
5	Press ENTER The zone assignment and set-back/occupied values for both heating and cooling are cancelled. (The Optimal Start "profile" developed by the system remains in memory.)	
6	Position RUN/CHANGE switch to RUN	

4.3.4 Programming Temperature Compensated Duty Cycle

In order to program the Temperature Compensated Duty Cycle function, the following types of data will be required: (1) The circuit and schedule to be affected; (2) the zone number of the temperature sensor to be used; (3) the base temperature at which compensation is to begin as temperature exceeds this value; (4) the temperature deadband for which no compensation is to take place (Note: This deadband region is immediately below the base temperature), and (5) the number of minutes per degree by which the duty cycle pattern is to be compensated for each degree that the measured temperature is outside the deadband region (i.e., greater than the base temperature or less than the base temperature minus the deadband)

In the manner described above, the same circuits can be programmed for year round control of heating and cooling. The following example illustrates the calculations for a cooling situation.

CURRENT TEMP (CT) = 76, BASE TEMP (BT) = 74, DEADBAND = 4

MIN/DEG = 3

$(CT - BT) \times \text{MIN/DEG} = \text{CYCLE VARIANCE}$

$(76 - 74) \times 3 = 2 \times 3 = 6 \text{ Minutes Offset}$

STANDARD DUTY CYCLE = 45 minutes ON/15 minutes OFF

+6 minutes (ON) -6 minutes (OFF)

NEW CYCLE = 51 min ON/9 min OFF

For a heating environment the calculations would be as follows:

CURRENT TEMP (CT) = 67, BASE TEMP (BT) = 74, DEADBAND (DB) = 4,

MIN/DEG = 3

$[(BT - DB) - CT] \times \text{MIN/DEG} = \text{CYCLE VARIANCE}$

$[(74 - 4) - 67] \times 3 = 9 \text{ minutes offset}$

STANDARD DUTY CYCLE = 45 minutes ON/15 minutes OFF

+9 minutes (ON) -9 minutes (OFF)

NEW DUTY CYCLE = 54 minutes ON/6 minutes OFF

In the above examples no compensation of the duty cycle pattern is performed whenever the current temperature of the specified zone is in the range of 70-74° F. Modification of the duty cycle pattern is performed only if the zone temperature falls below 69° or rises above 74°

The objective is to adjust the current temperature closer to the base temperature by altering the duty cycle to keep equipment ON for a longer period of time. As the current temperature changes, the Powersense 830 recalculates the duty cycle variance at the end of the duty cycle. In the cooling example, if the new current temperature reaches 75° at the end of the duty cycle OFF period, the new offset becomes only three minutes. If the temperature has reached 74° or below, the normal duty cycle returns. The duty cycle variance may be programmed differently for each circuit in the 830.

It is possible to have one sensor modify the duty cycle patterns of several circuits. For example, all circuits on a duty cycle strategy may be "linked" to the Zone 1 sensor for compensation based on outdoor temperature. For circuits that control equipment which performs both heating and cooling, it is possible to program the unit to modify the duty cycle pattern in the event of either an increase or decrease in measured temperature and use a fixed duty cycle in some deadband region.

Use the following charts to enter/change, check, and cancel
TEMPERATURE COMPENSATED DUTY CYCLE:

Enter/Change Temperature Compensated Duty Cycle

STEP	USER ACTION	PROMPT
1	Position RUN/CHANGE switch to CHANGE	CIRCUIT(S)
2	Press TEMP COMP D/C	
3	Enter a circuit number in the range of 01 to 30.	
4	Enter a single digit schedule number.	SCHEDULE ZONE
5	Enter a zone number between 1-8. If zone 1 is used, duty cycle pattern will be compensated on outdoor temperature.	BASE TEMP
6	Enter the base temperature for <u>cooling</u> equipment. The ON portion of the duty cycle is lengthened when the temperature in the assigned zone rises above this value. (Range: 0-120 Deg F)	
7	Press NEXT	DEADBAND
8	Enter a temperature deadband range (in Deg F) for which no compensation of the duty cycle pattern is to be performed. This value is subtracted from the BASE TEMP value to determine the temperature at which temperature compensated cycling should begin for <u>heating</u> equipment. (Range: 0-120 Deg F)	
9	Press NEXT	MIN/DEG
10	Enter the number of minutes per degree by which the duty cycle pattern is to be compensated when the temperature in the zone is outside the deadband region (i.e., greater than BASE TEMP or less than BASE TEMP minus DEADBAND). (Range: 0-100)	
11	Press NEXT	ENTER
12	Press ENTER	
13	Position RUN/CHANGE switch to RUN	

Check Temperature Compensated Duty Cycle

STEP	USER ACTION	PROMPT
1	Press CHECK	
2	Press TEMP COMP D/C	CIRCUIT(S)
3	Enter a circuit number in the range of 01 to 30. The status indicator is lit for the circuit selected. The BASE TEMP, DEADBAND, and MIN/DEG values will appear in the display windows for schedule 1. The appropriate lamp under Zone lights for the assigned temperature zone.	CIRCUIT(S)
4	Press NEXT as required to review temperature compensated duty cycle information for schedules 2 - 9.	CIRCUIT(S)
5	Enter additional circuit numbers if desired, to check temperature compensated duty cycle information for other circuits (i.e., repeat steps 3 & 4)	
6	Press CLEAR twice to return to normal operation.	

Cancel Temperature Compensated Duty Cycle

STEP	USER ACTION	PROMPT
1	Press RUN/CHANGE switch to CHANGE	
2	Press TEMP COMP D/C	CIRCUIT(S)
3	Enter a circuit number in the range of 01 to 30.	SCHEDULE
4	Enter schedule number of schedule to be cancelled.	ZONE
5	Press CANCEL	ENTER
6	Press ENTER	
7	Position RUN/CHANGE switch to RUN	

4.3.5 Check Temperature

Follow the steps in the below chart to check the current temperature of any zone, including the outdoor temperature.

Check Timer

STEP	USER ACTION	PROMPT
1	Press CHECK	ZONE ZONE
2	Press TEMP	
3	Enter zone number (1-8). The current temperature will appear in the top display window. Repeat this step for each zone.	
4	Press CLEAR twice when finished.	

When checking temperatures, the model 830 will report the temperature at the instant the CHECK TEMP sequence is initiated. If the temperature of a zone is changing and it is desired to continuously monitor the temperature from the front panel, it will be necessary to continuously re-enter the zone number (every 5 to 10 seconds) for as long as necessary.

The 830 will produce a reading of -29 degrees F during this sequence if no sensor is connected or if there is an open circuit condition for the zone checked. Conversely, a reading of +123 degrees F will result if the sensor inputs are short circuited (zero ohms) for any reason.

4.3.6 Programming Temperature Compensated Setpoint

If the Multiple Setpoint Option is installed, the unit will ask for you to designate the setpoint number. If not, the unit will assume setpoint 1 and will ask you for a base temperature (outside). In this sequence, the major prompt is KW/DEG, which asks how many kilowatts should be added to the setpoint for every degree difference between the outside temperature and the base temperature. The example below (similar to the TEMP COMP DUTY CYCLE examples) shows the calculations for a cooling environment.

OUTSIDE TEMP (OT) = 90 BASE TEMP (BT) = 85 KW/DEG = 10

$(OT-BT) \times KW/DEG = \text{setpoint variance}$

$(90-85) \times 10 = 5 \times 10 = 50 \text{ kilowatts variance}$

SETPOINT = 750

NEW SETPOINT = 750 + 50 = 800 KW

Use the following programming charts to enter/change, check, and cancel Temperature Compensated Setpoint data:

Enter/Change Temperature Compensated Demand Setpoint Information

The setpoint value can be changed as a function of outside temperature. If the base temperature is 55°F or above, the unit assumes a cooling environment. For each degree above the base temperature for the selected setpoint, the unit will add the specified number of kilowatts to the setpoint value. If the base temperature is below 55°F, the Powersense 830 assumes a heating environment and adds the specified number of kilowatts to the setpoint for each degree below the value of the base temperature.

STEP	USER ACTION	PROMPT
1	Position RUN/CHANGE switch to CHANGE	NUMBER* BASE TEMP
2	Press TEMP COMP S/P	
3*	Enter setpoint number (1-5).	
4	Enter a base temperature value in the range of 0-120 degrees F. The value will be displayed in the upper window.	KW/DEG
5	Press NEXT	
6	Enter a kilowatt value between 1-200. This value is per degree. An entry of 200 would alter the setpoint by 1000 KW with a 5 degree difference between the base and outside temperatures.	
7	Press NEXT	ENTER
8	Press ENTER	
9	Position RUN/CHANGE switch to RUN ~	

* Only if the Multiple Setpoint Option is installed.

Check Temperature Compensated Demand Setpoint Information

STEP	USER ACTION	PROMPT
1	Press CHLCK	NUMBER*
2	Press TEMP COMP S/P	
3*	Enter a setpoint number (1-5)	
4	The base temp value will be displayed in the upper window; the KW/DEC value in the middle window.	
5*	Additional temperature compensated setpoint information can be checked by entering the desired setpoint number.	
6	Press CLEAR twice to return front panel to normal operations.	

* Only if Multiple Setpoint Option is installed.

Cancel Temperature Compensated Demand Setpoint Information

STEP	USER ACTION	PROMPT
1	Position RUN/CHANGE switch to CHANGE	NUMBER* BASE TEMP ENTER
2	Press TEMP COMP S/P	
3*	Enter setpoint number (1-5).	
4	Press CANCEL	
5	Press ENTER The designated setpoint is no longer available for temperature compensated control.	
6	Position RUN/CHANGE switch to RUN	

* Only if Multiple Setpoint Option is installed.

V. Timed Override Option

With the TIMED OVERRIDE OPTION installed, the Powersense 830 can be programmed to recognize up to eight remote momentary contact switches (i.e., push buttons) to temporarily extend the ON time of a given circuit(s). This extended ON period does not begin until a remote switch closure is received, at which point the 830 will temporarily switch ON the preassigned circuit(s) and begin a countdown for the specified period.

Once the specified countdown has elapsed, the assigned circuit(s) will be switched OFF. If the remote switch closure occurs prior to the end of the period, the affected circuit(s) will be immediately switched OFF. A third switch closure would then re-initiate the Timed Override period for its full value (the same as if it were the first switch closure received).

5.1 Installation of Timed Override Option

Slot H and the corresponding terminal block located inside the Powersense 830 in the upper right hand portion of the unit are dedicated to the Timed Override Option. Insert the TIMED OVERRIDE OPTION CARD (Figure 5.1) into slot H and wire the remote momentary pushbutton switch from any one of the terminals on block H to the ground inside the Model 830. The zone 1 pushbutton is to be connected to terminal #1 of block H, zone 2 to #2, etc. DO NOT CONNECT OR APPLY ANY OUTSIDE VOLTAGES TO THIS LINE, AND USE ONLY THE GROUND TERMINAL INSIDE THE POWERSENSE 830. See Figure 5.2 for a wiring diagram. Shielded cable is not required if the wiring is run clear of high voltage sources, transformers, etc.

CAUTION

Input (sensor) cards should not be inserted or removed from the Model 830 without first shutting off power to the unit or pressing the System RESET button while the change is made. Inserting or removing input cards with power applied may cause the microprocessor to lose its place and stop operating.

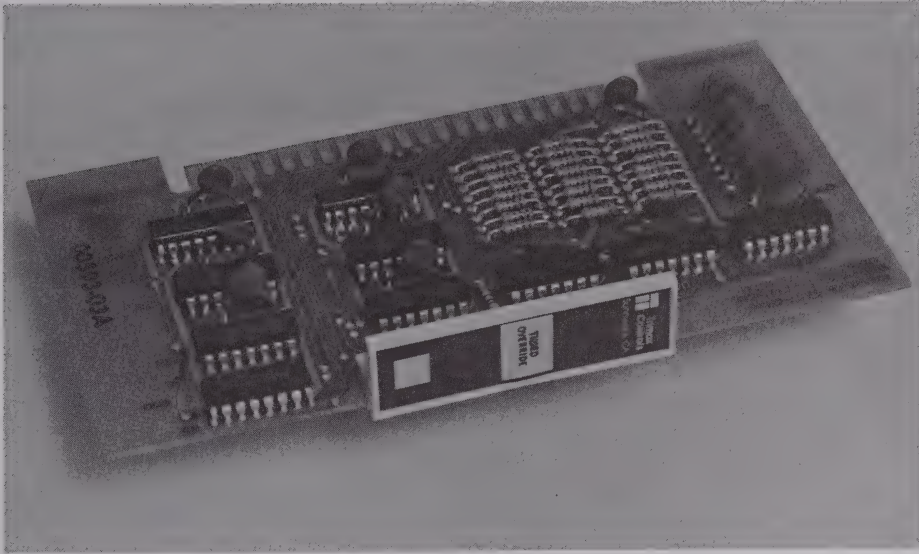


Figure 5.1: Timed Override Option Card

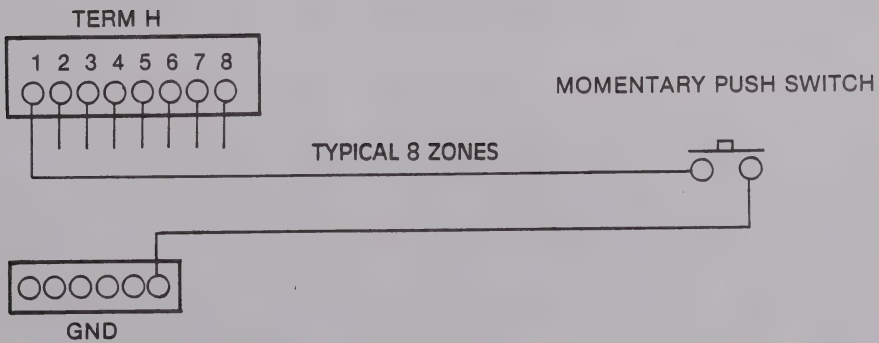


Figure 5.2: Wiring Timed Override Switch Inputs

5.2 Programming Timed Override

The ZONE prompt lights are used by both the Timed Override Option and the Temperature Input Option during the programming phase. There is no requirement that the temperature and timed override zones cover the same physical areas of the facility. The two functions are independent. You are free to lay out the zones in any manner suitable to the facility.



In the RUN mode the 830 will light the appropriate amber ZONE prompt lights for any active timed override zones. Upon completion of the timed override period, the lamp will be switched OFF along with the assigned circuit(s).

Refer to the following programming charts to enter/change, check, or cancel Timed Override information:

Enter/Change Timed Override Values

STEP	USER ACTION	PROMPT
1	Position RUN/CHANGE switch to CHANGE	ZONE CIRCUIT(S)
2	Press TIMER	
3	Enter zone number in the range of 1-8.	
4	Enter one or more 2-digit circuit number(s). The ON indicator for the desired circuit will light.	
5	Press NEXT	TIMER
6	Enter time value between 1 min. and 12 hours and 59 mins (1259). This will appear in the middle display window.	
7	Press NEXT	ENTER
8	Press ENTER	
9	Position RUN/CHANGE switch to RUN	
	Upon receipt of a momentary switch closure, circuit(s) assigned to that zone will be switched ON in 15 second intervals (if not previously scheduled ON). The appropriate amber lamp under ZONE will light for the duration of the timed override period.	

Check Timed Override

STEP	USER ACTION	PROMPT
1	Press CHECK	ZONE
2	Press TIMER	
3	Enter zone number.	
4	The ON indicators for the circuits assigned to this zone will light. The full timed override value for the zone will appear in the middle display window. If active, the time remaining for this zone will be displayed in the lower window. If not currently active, the full time value will also be displayed in the lower window.	
5	Press CLEAR twice to return front panel to normal operation.	

Cancel Timed Override

STEP	USER ACTION	PROMPT
1	Position RUN/CHANGE switch to CHANGE	ZONE CIRCUIT(S) ENTER
2	Press TIMER	
3	Enter a zone number.	
4	Press CANCEL	
5	Press ENTER	
6	Position RUN/CHANGE switch to RUN	

VI Multiple Setpoint Option

The Multiple Setpoint option allows a user to enter up to five demand setpoint levels. There are no user adjustments on the Multiple Setpoint Card (Figure 6.1). If this option is not installed, the Powersense 830 uses a single setpoint value at all times (i.e., setpoint #1).

In many areas, utilities calculate demand charges depending upon the time of occurrence of the demand peak. There are frequently three basic times of day for charges: on-peak (typically 10 a.m. to 6 p.m.), mid-peak (6 p.m. to 10 p.m. and 6 a.m. to 10 a.m.), and off-peak (10 p.m. to 6 a.m.). With the Powersense 830, a maximum demand level can be set for each of these periods. Also, when used with an external switch closure, the Multiple Setpoint option can be configured to select different setpoints based on external conditions (e.g., a higher demand level on an extremely hot or cold day). A sixth setpoint (referred to as "NONE" on the front panel) allows the user to disable all demand limiting functions of the Model 830.

Setpoints can be selected in one of two ways: (1) through a remote switch closure; or (2) programmed by the SCHED sequence as a

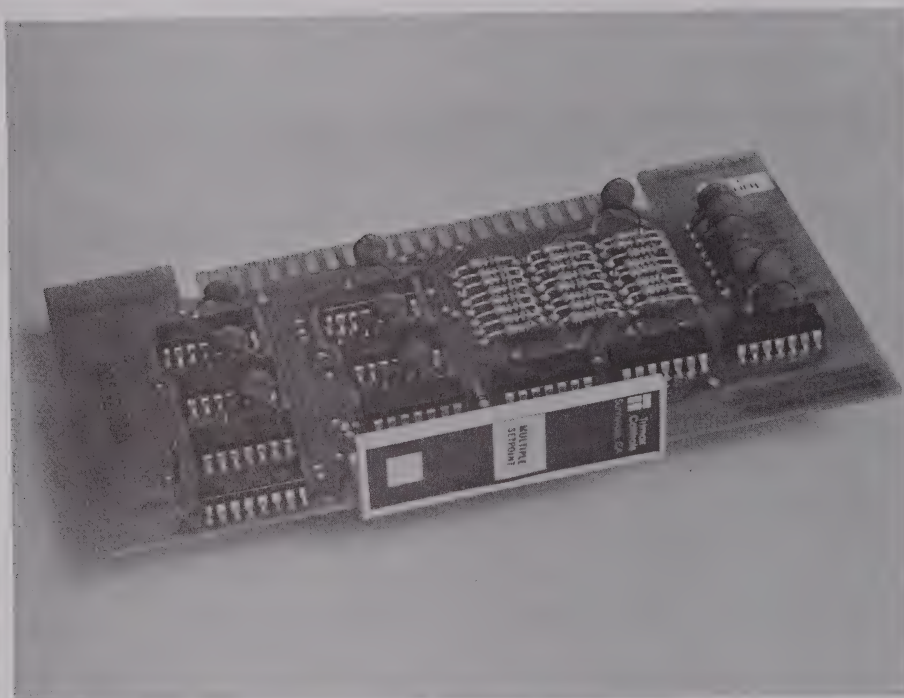


Figure 6.1: Multiple Setpoint Option Card

function of time of day. In the latter method, SCHED addresses the setpoints as if they were circuits. Consequently, each setpoint requires an address designation akin to a circuit. For scheduling purposes, the setpoints are addressed as circuits 31 to 36. Scheduling "circuit" number 36 ON causes the NONE light under setpoint selected to light whenever scheduled ON. This indicates that the 830 has been instructed to perform no demand limit control during the time period that circuit 36 is ON.

 Note

It is possible for a conflict to arise if you program both a setpoint and have a switch closure for a select setpoint (e.g., the switch closure selected setpoint number 1 while the 830 is programmed to select circuit 33, or setpoint number 3). If a conflict arises, the system defaults to the lower numbered setpoint. It is imperative that the lower setpoint levels, therefore, be entered in the lower number setpoints (setpoint #1 = 750 KW, setpoint #2 = 1,000 KW, setpoint #3 = 1,300 KW, etc.).



You cannot duty cycle a setpoint. The duty cycle function will not accept a number greater than 30. You can, however, schedule your setpoints for holidays or special days.

6.1 Installation of the Multiple Setpoint Option

Insert the Multiple Setpoint Select Card into Slot G, which is located inside the Powersense 830 in the upper half of the unit. Once the card is inserted, setpoints can be programmed through the front panel, as circuits 31 - 36.



No switch closure is needed to select setpoint #1 (default). To remotely select a different setpoint, connect a normally open contact across the connection on terminal block G corresponding to the desired

setpoint (connections 2 - 6) and ground on the bottom terminal block (GND). To illustrate this, a maintained switch closure from connection 2 on terminal block G to ground selects setpoint 2 for the duration of the closure.

 CAUTION

Input (sensor) cards should not be inserted or removed from the Model 830 without first shutting off power to the unit or pressing the System RESET button while the change is made. Inserting or removing input cards with power applied may cause the microprocessor to lose its place and stop operating.

As a unique feature of the Powersense 830, a momentary switch closure can be run to connection #8 to provide a peak reset line. The unit retains all peak values but at the end of the billing period, when the demand meter has been read, the values should be reset to zero. To accomplish this, a push button can be mounted near the demand meter, and connected across terminal #8, block G and ground. When the monthly reading is taken, the meter reader can be instructed to press the button to reset all KW and KWH

values to zero. (Note that this is the same as setting the peak values to zero using the PEAK key on the front panel). Figure 6.2 shows a typical wiring diagram for the Multiple Setpoint Option.

6.2 Programming Multiple Setpoint

Entering/changing, checking, and cancelling program data for the Multiple Setpoint Option is the same as the steps for Programming SETPOINT, TEMP COMP SETPOINT, AND ALARM LVL as described in Chapter 3, Section 3.3.1 of this manual.

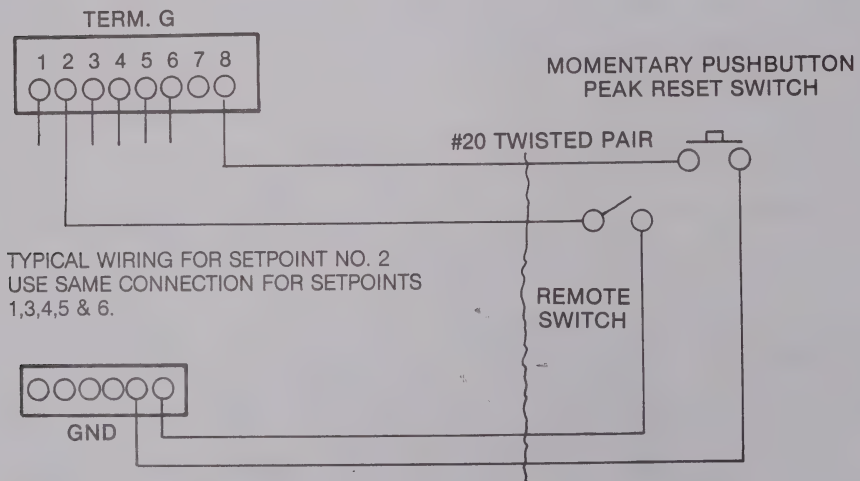


Figure 6.2: Wiring Diagram for Multiple Setpoint Option Card

VII Strip Chart Recorder

When configured with the Strip Chart Recorder Option, the Model 830 is capable of plotting a graphic representation of facility demand as a function of time. (Note that the Demand Control Option must be installed and functional in order to provide the demand data to be plotted on the Strip Chart Recorder).

7.1 Installation

The Model 830 is shipped with the Strip Chart Recorder unit installed. There is also an option card labelled "STRIP CHART RCDR" (see Figure 7.1) that must be inserted into Slot P in order to operate the recorder. Install the card in the same manner as the input option cards by pressing the RESET or switching OFF power to the 830 while carefully inserting the card. No additional wiring should be needed. Locate Terminal Block P; there should be a white lead connected to terminal #4 and an orange wire connected to terminal #6. These wires form a harness that runs into the power supply section of the 830 and to the recorder movement.

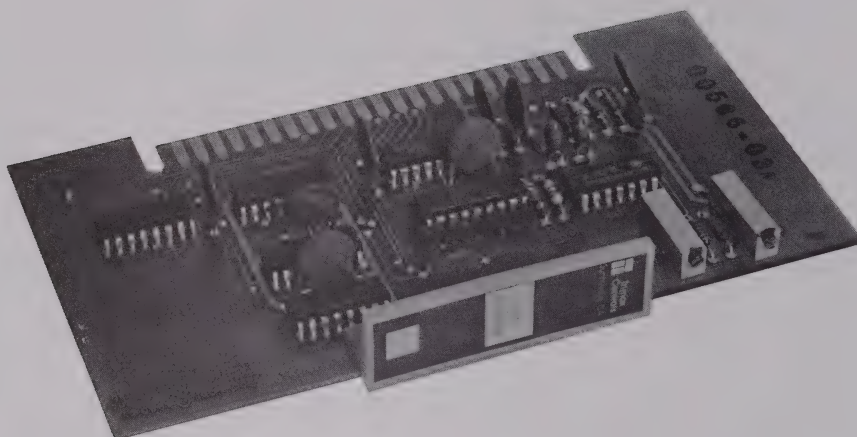


Figure 7.1: Strip Chart Recorder Card

Perform the following sequences to load paper:

- 1) Unscrew the thumbscrew located in the upper left corner of the recorder and tilt the mechanism outward and down (pivot point is at the bottom of the unit).
- 2) Refer to the diagram visible inside the recorder under the take-up roller.
- 3) Slide the 2 retaining clips on each side toward the front of the unit to release the supply roll and take-up roller.
- 4) Open the chassis latch on the right side of the unit.
- 5) Insert the supply roller into the paper well and unroll about 8" of paper.
- 6) Replace the supply roll and take-up roller. The shoulder of the aluminum supply roller and the sprocket holes in the paper should both be on the left side.
- 7) Feed the paper around the drive drum and slide the paper sideways into the unit through the open chassis latch. Insure that the sprocket holes are aligned with the protrusions on the drive roller.

- 8) Feed the loose end around the drive belt roller and tape to the empty cardboard spool. Insert the take-up roller into the cardboard spool with the brass gear on the left side.
- 9) Re-position the take-up roller with the paper wound as tightly as possible.
- 10) Close the chassis latch.
- 11) Close the unit by pivoting the recorder back into the 830 and tightening the thumbscrew.
- 12) Advance the paper (using the thumb dial on the front of the unit) until the time markers on the left side of the paper agree with the current time of day. (Each square on the paper represents 15 minutes in the time direction).

Note

The paper advancement mechanism is very accurate and should stay synchronized with the system clock. Accuracy of the Strip Chart Recorder paper advance is considerably less if the take-up roll is removed and torn off before the supply roll is empty. For best results, an entire roll of paper should be run through the recorder intact.

If desired the Strip Chart Recorder may be powered off by opening the unit and unplugging the cable from power supply at the connector labelled "P1". Power to the unit may be restored by replacing the power cable (note the position of the polarizing key in the connector).

7.2 Operation

The recorder will provide a continuous graph of the value displayed in the PRESENT DEMAND window. This is the average demand of the facility over the averaging interval specified via the SETPOINT key. As such, the plot will show a lag in response to when very large loads are switched ON or OFF. The 830 will automatically scale the plot so that the setpoint value becomes 80% (or .8) of full scale on the recorder. (This leaves a 20% safety margin in the event that the present demand value actually exceeds the setpoint). If no setpoint is entered, the 830 assumes a setpoint value of 10,000 KW and very little deflection will be visible on the recorder needle.



If the Multiple Setpoint Option is installed in the unit and different setpoints are used, there will be a discontinuity in the plotted curve when the change from one setpoint to another occurs. This is due to the automatic scale feature based upon the setpoint value and the resultant recalculation of the full scale deflection value.

7.3 Paper

The recorder paper moves at a speed of one inch per hour (4 divisions per inch), and is 30 feet long; thus one roll of paper should last 30 days. A red band on either side of the paper indicates the end of the roll. When the red band appears, the paper should be replaced. Follow the instructions in section 7.1 to load paper.

Recorder paper (P/N 1059-09) is packaged 6 rolls to a carton and may be ordered directly from Trimax by calling: (800) 538-1884 (California, Alaska & Hawaii: (408) 737-0950).

VIII Pulse Output Circuit Master Card

The Pulse Output Circuit Master Card (Figure 8.1) is useful in applications that utilize pulsed or latching relays for motor control, low voltage lighting control, etc. Instead of maintained relay closure, the Pulse Circuit Master Card provides a momentary contact closure between the COM and NO or COM and NC terminals, depending on whether the circuit is being switched ON or OFF. The duration of the closure is approximately $3/4$ of a second and occurs only when an ON/OFF control action is called for.

This optional Circuit Master Card generally requires 3 wires to be connected to the external relay in order to provide full ON/OFF control of the load. In some cases, it may be desirable to connect only the OFF pulse of the 830 thereby requiring only 2 wires. An example might be a low voltage lighting system where the 830 is used to periodically switch OFF lights in a facility. The ON pulse would be furnished by a momentary type switch located in the office served by the lighting load.

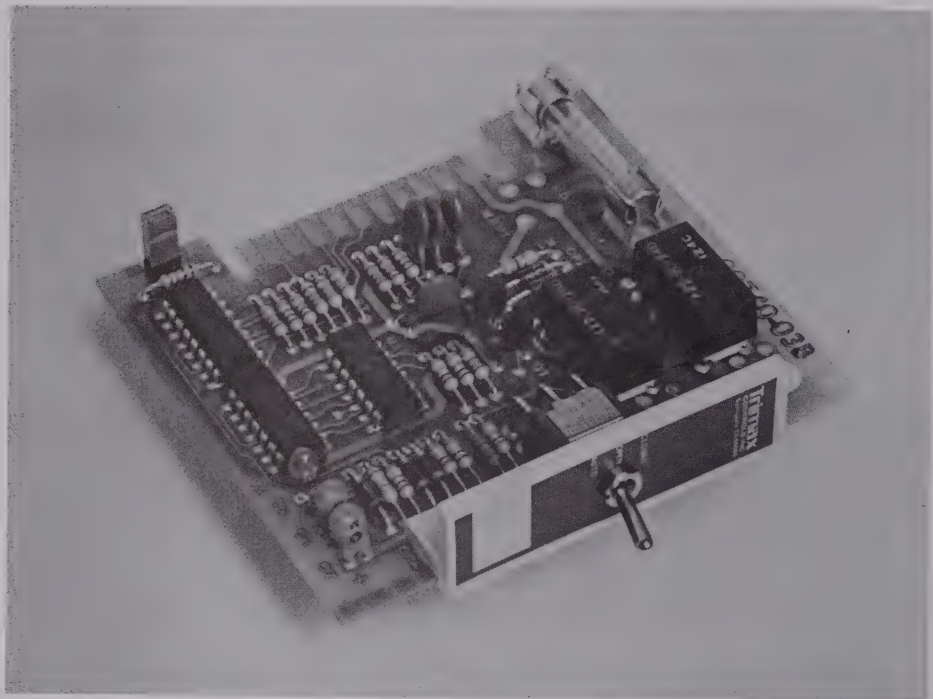


Figure 8.1: Pulse Output Circuit Master Card

8.1 Wiring

When wiring the Pulse Output Circuit Master Card, the NO and NC terminals become the OFF and ON output lines respectively. The COM connection remains common.

Insert this card into to any of the slots normally used by the Circuit Master Cards.

Note

The Pulse Output Circuit Master Card is shipped configured with the Remote Load Sense feature for use with a confirming switch closure. If no proof-of-flow verification is available for connection to the R-SEN terminal, it will be necessary to remove a small blue jumper labeled JUI/REMOTE in the corner of the card opposite the fuse (see Figure 8.1). If this jumper is not removed and no confirming switch closure is present on the R-SEN line, the unit will indicate an override for the circuit on the front panel, and the audible alarm will sound.

IX Serial Communication Option

9.1 Introduction

The Serial Communication Option (P/N 517-03) provides local or remote access and programming capability for the Powersense 830. Through the use of an optional FCC-approved auto-answer modem (Modulator/DEModulator), the user can program and check all of the Powersense 830 programs from a remote site over standard telephone lines. Remote or local programming and access can be accomplished through the use of a standard TTY compatible keyboard/printer or CRT terminal.

All status and program information resident in the Powersense 830 may be called up for display on the data terminal or monitor. Changes can be made and new information entered through the serial communication interface. Storage and recall of the Powersense 830 data history is provided by the Data Logging Option (see Chapter 10).

Programming the 830 is made easier by the Serial Communication capability. The only training required for programming and entering new data is the basic understanding of the Powersense 830 front panel operations. User interaction at the keyboard/terminal closely parallels that of programming the unit at the front panel.

9.2 Modem and Data Terminal

An optional FCC-approved auto-answer modem serves as the interface between the Powersense 830 and the telephone lines. The auto-answer feature permits the modem to automatically answer incoming calls and establish the communications link. Upon completion of the communications dialogue, the modem automatically returns the telephone line to the "on-hook" condition.

Trimax offers a compatible data terminal with an integrated acoustical coupler for use with the Serial Communication Option. The terminal provided by Trimax is the Texas Instruments Silent 700 (model 745) shown in Figure 9.1.



Figure 9.1: Texas Instruments Silent 700

The optional portable keyboard/printer unit with acoustic coupler provides a compatible peripheral for remote communications, data entry, and the production of hard copy (non-impact thermal printing) records. Records of all communications and/or data history may be retained for later reference. The acoustic coupler accepts a standard telephone receiver and does not require an electrical connection to the telephone lines.

Typically, a "dumb" terminal is used at the central site for communication with the Powersense 830. At the user's discretion, communication is established by dialing the telephone number to which the auto-answer modem is connected. When communications are established, the Powersense 830 terminates any further user activity at the front panel and interacts with the central site via the serial port connection.

Communication is performed in asynchronous full-duplex mode, at a factory set baud rate of 300. However, 1200 baud can be selected by switches resident on the Serial Communication Option Card.

Some applications may require the control of one or more Powersense 830 systems by a mini or microcomputer rather than a data terminal. Virtually any computer can be adapted to do so with commercially available interfaces. Such applications might include the change over programming of multiple 830 units from

summer to winter schedules. The computer can dial up each unit and transmit the schedule changes from pre-programmed files stored on flexible disks. The user can also generate full-scale, complex programs to perform detailed monitoring of the Powersense 830 around the clock. Trimax offers a software package for the Apple II personal computers that performs automated central site operations of this nature.

9.3 Installation of the Serial Communication Option

The Serial Communication Option is provided as a plug-in printed circuit card. The card resides in a slot dedicated to serial communication and requires no terminal block wiring. (Fig 9.1.1)

The Serial Communication Card may be installed in one of two input card slots in the Powersense 830 unit - Slot A or Slot I. Slot A is located in the upper left corner inside the Powersense 830 unit. Slot I is located directly below Slot A.

If the Serial Communication Option Card is to be used in conjunction with an auto-answer modem, the card must be inserted in Slot A, next to the port labeled "TO MODEM". If it is to be

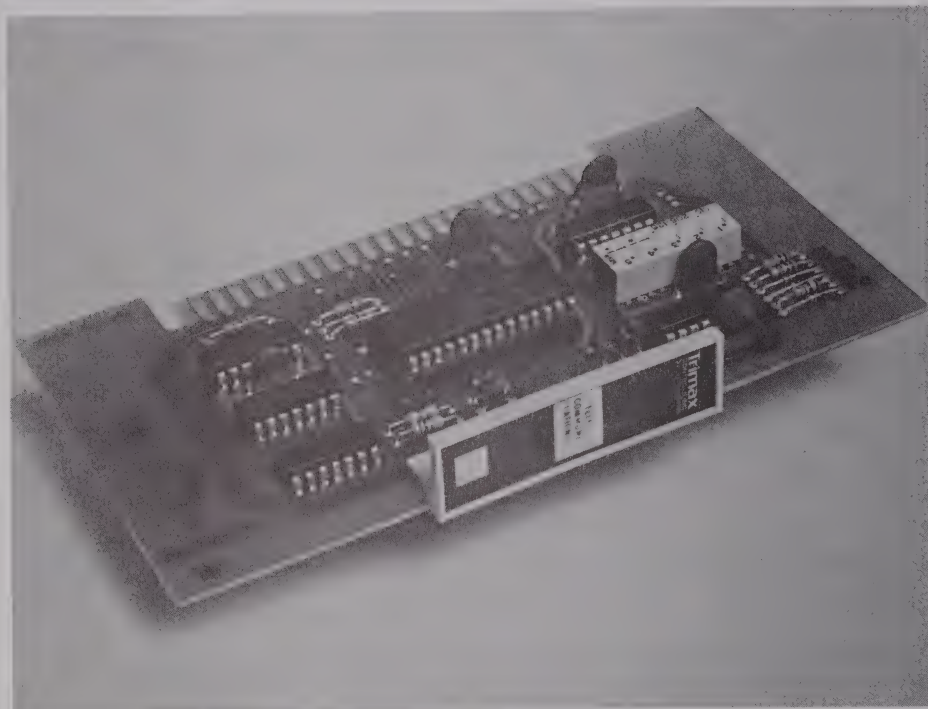


Figure 9.1.1: Serial Communications Option Card

used with a direct terminal, the Serial Communication Card must reside in Slot I, next to the port labeled "TO TERMINAL". To the left of each slot is a standard 25-pin RS-232 connector.

For all installations, the following instructions must be observed.

1) Open the front case assembly and locate the appropriate connector in the upper left-hand corner of the Powersense 830.

2) Using standard pliers, remove the pre-cut knockout that covers the desired connection when the case assembly is closed. The top knockout is for the modem connection, while the lower knockout is for the direct terminal connection. The rectangular knockout plate can be worked loose with a minimum of bending effort.

3) The Serial Communication Option card (which may be marked "Telecommunications") will require setting of the 5 small switches in order to configure the card for correct operation. To set the switches, lay the card on a flat surface and orient it so that the handle is at the top and the numbers on the switch block (left center of card) are readable. The switches will be either the rocker or switch type, depending on the revision level of the card you have. In either case, each switch will be labeled with a number between 1 and 5.

The rocker switches are set to the ON position when pressed on the numbered side (there is also a small "A" next to the number). Press on the "B" side to set the switch to the OFF position.

If your card has the slide type switches, slide the small white plastic block toward the number for ON and away from the number for OFF.

The meaning and setting of each switch is as follows:

a) Switch #1: ON (numbered side) selects 1200 baud.
OFF selects 300 baud.

b) Switch #2: Should be OFF at all times. (Note: This switch controls the CTS line [pin 5] of the serial interface. Setting to the ON position allows external control of the line. Do so only after verification that the equipment connected to the serial port is capable of controlling CTS).

c) Switch #3: selects whether DCD (pin 8) or DSR (pin 6) of the Serial Port is to be used by the 830. Set to ON position if a terminal is connected directly to the 830 (card installed in Slot 1); DSR is selected. Set

to the OFF position if a modem is used (card inserted in Slot A); DCD is selected.

d) Switches #4 and #5: These switches interchange the Transmit Data (TD) and Receive Data (RD) lines of the serial interface (pins 2 and 3 respectively). They must always be set to the same position. ON selects normal operation and should be used in almost all cases. In some situations, using direct connection of a terminal, it may be necessary to interchange TD and RD by setting the switches to the OFF position.

4) Either remove power from the unit or press and hold in the RESET button before inserting the Serial Communication Option Card. The RESET button is the uppermost of the two square buttons on the backside of the front door.

5) Insert the Serial Communication Option Card into either Slot A or Slot I as appropriate. The card should be firmly held by the handle and pressed into the connector slot without forcing it. Gently rock the card up and down while pressing until the card is firmly seated.

6) Connect the RS-232 cable to the appropriate port and tighten screws on connector. Close front case assembly and re-install the 3 pan head screws that secure the case to the wall mounting plate.

9.4 Modem Installation

The Powersense 830 requires an external auto-answer modem if communication via telephone lines is to be performed. All modems must be certified by the Federal Communications Commission to ensure that minimum isolation specifications are met by the unit.

The device performs several vital functions. The modem:

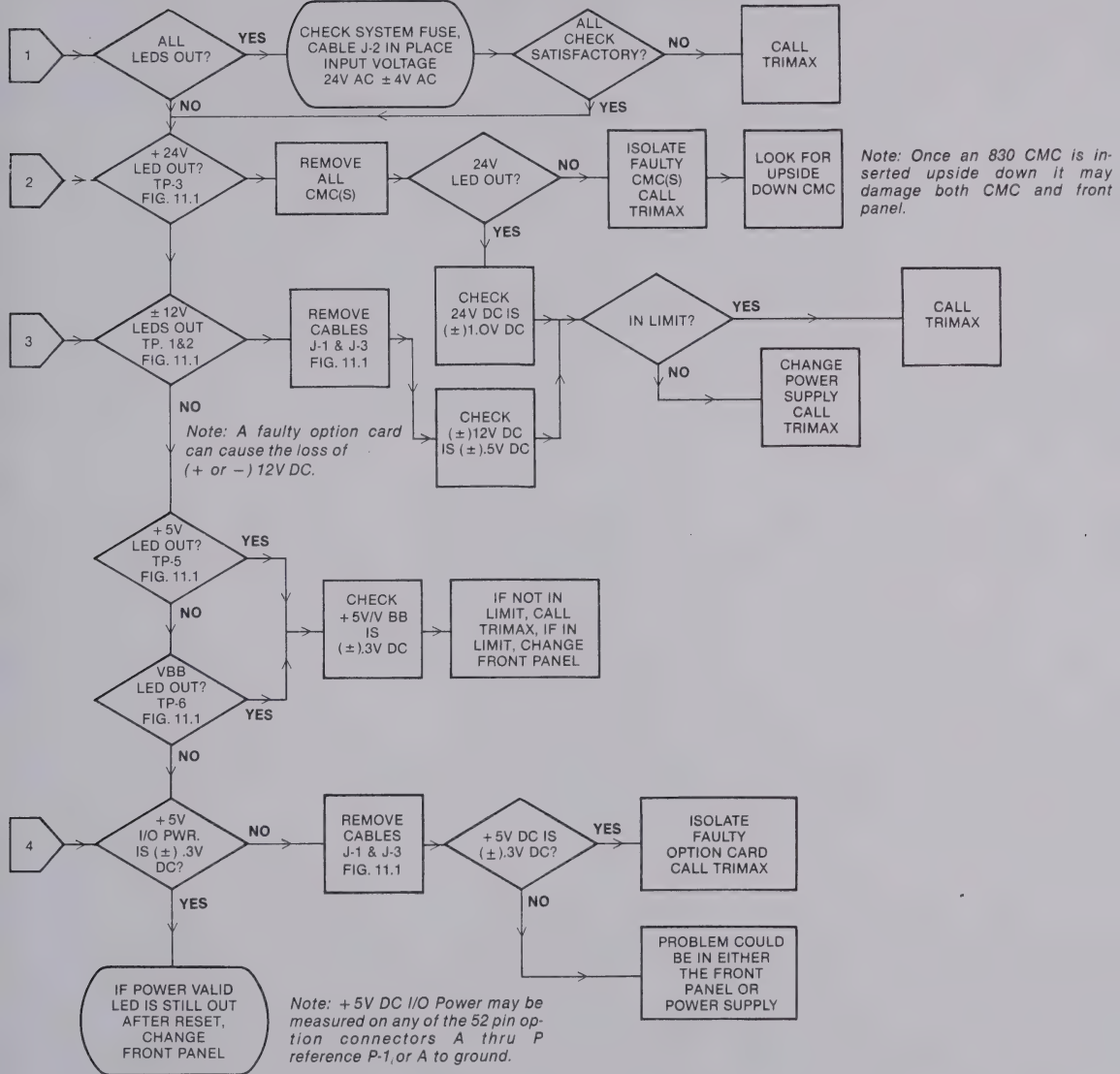
- * Provides voltage isolation between the Trimax unit and the telephone lines in order to prevent damage to one system by the other.

- * Automatically answers incoming calls and returns the telephone lines to the "on-hook" condition upon termination of the dialogue. (The modem must be of the auto-answer type in order to perform this function.)

- * Performs the translation of computer-type digital signals into a series of frequency modulated tones that can be sent over standard voice-grade lines.

Voltage Check

Note: System fuse is 5 amp SLO BLO only.



11.3 Returning Equipment to the Trimax Factory

If equipment must be returned to the factory for any reason, please follow these instructions.

1. Call the Field Service Department at the factory and request a Returned Goods Authorization (RGA) number. This number must appear on the outside of any and all cartons returned to Trimax.
2. Write a short note describing the reason for the return and enclose it with the component or equipment. The note should describe any symptoms or observations regarding non-operational components and a list of any diagnostic tests performed to isolate the fault.
3. Re-pack the equipment in the original shipping cartons using the original containers if possible.
4. When returning front panel assemblies or printed circuit boards, be especially careful to use static free packing materials. If possible use the same pink plastic bags used in the original shipment.

 CAUTION

All printed circuit components (chips) are easily damaged by electro static discharge (ESD). Extreme care should be used to avoid use of packing materials that retain high static charges (i.e., Peela Span "peanuts", cloth, etc.).

5. Ship pre-paid via UPS or other suitable carrier to:

Trimax Controls, Inc.
1180 Miraloma Way
Sunnyvale, CA 94086

Attn: Field Service Dept.

RGA # _____

XII Appendices

A. Powersense 830 External and Mounting Dimensions

All dimensions are noted in inches.

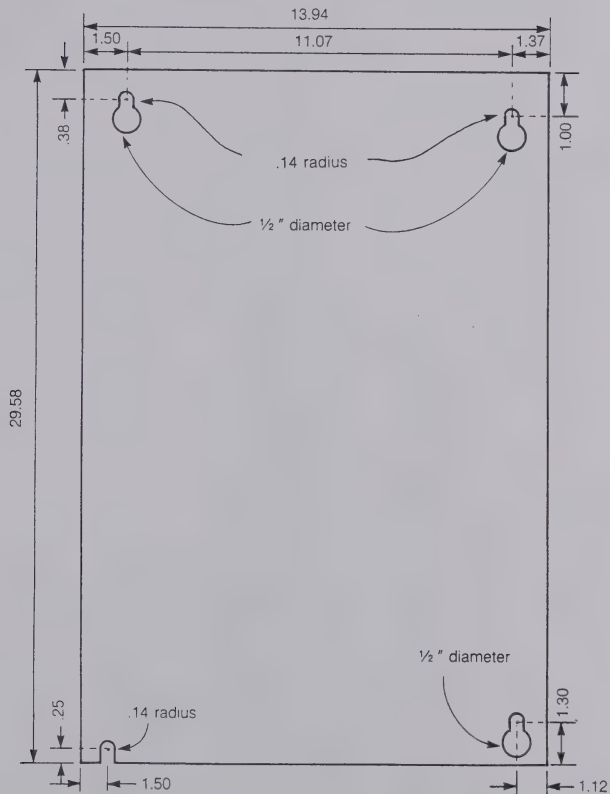
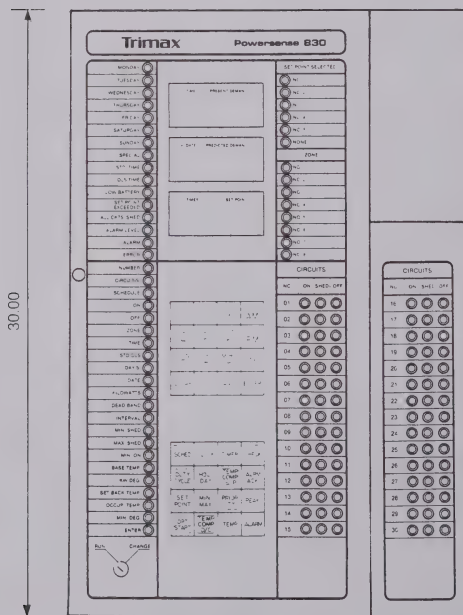


Figure A1: Wall Mounting Plate Dimensions



B. Powersense 830 Specifications**Electrical Ratings**

Power Input	24VAC $\pm$ 4 VAC, single phase 50 or 60 Hz 100 VA maximum
Fusing	Main 24V power - 5 amp Slo-blo Output Circuits - 2 amp Slo-blo
Battery Back-Up	9 volt alkaline (NEDA 1604 or equivalent) Maintains clock & programs up to 5 days Low battery alarm @ 7.5 volts Useful life down to 6.5 volts
Output (Control) Relays	24VAC, 2 amp (fused) Form C with both N.O. & N.C. Contacts True open/closed override per circuit
Remote ON/OFF Overrides	Simple contact closure for each circuit

Environmental Ratings

Ambient Operating Temp.	32°-122°F (0°-50°C)
Ambient Relative Humidity	10%-95%, non-condensing

Physical

Dimensions	30" (H) x 14-7/16" (W) x 6" (D) (76.2 x 36.7 x 15.2 cm)
Weight	53 lbs. (24.1 KG)
Shipping Weight	60 lbs. (27.3 KG)
Paint Colors	Dark Blue - Sherwin Williams #SJ975 Light Blue - Pantone 219C

Wiring

Connections	Screw terminals
Access	Conduit access top & bottom of unit

Clock

Type	12 hour AM/PM format Day of week, date, month & year displayed AC line or quartz crystal may be selected for keeping time
------	--

Keyboard

Type	Large positive action for entry/ verification of all program information
------	---

Load Scheduler

Number of schedules per circuit per day	9
Maximum number of ON/OFF pairs	679
Number of holiday dates	30
Duty cycle ON/OFF periods	1 min. to 12 hours, 59 min. in 1 min. increments
Total possible duty cycle patterns to choose from	606,841
Staging of loads	15 seconds after power failure or whenever conditions call for multiple circuits to start at the same time

Demand Control Option

Inputs	0-1 ma DC signal from watt transducer and/or 2/3 wire input from pulse initiating demand meter
Pulse Metering	Measurement voltage supplied by controller 10VDC at 0.5 ma DC
Pulse Closure Rate	20 pulses/sec. max
Setpoints	1 std (5 optional)
Minimum Shed Time	0 min. - 12 hours, 59 min.
Maximum Shed Time	in 1 min. increments
Minimum On Time	

Temperature Input Option

Configuration	Plug-in card (max 2 per unit) 4 temperature inputs per card
Sensor Type	Thermistor (10,000 ohms @ 77°F)
Measurement Range & Accuracy	-10°F to + 110°F $\pm 1\frac{1}{2}$ °F
Setback Range	0°F to 110°F
Occupied Temp Range	0°F to 110°F
Optimal Start Range	2 min. to 8 hrs., 45 min.

Serial Communications Option

Baud Rate	300/1200 baud (switch selectable)
Communications	RS-232C ASCII characters, question/answer format
Terminal Required	TTY-type dumb terminal
Functions Allowed	All front panel operations
Maximum Cable Length to Terminal or Modem	1000 Ft. (304M)

Data Transfer Mode	Asynchronous, even parity, seven character bits, one start bit, one stop bit
Data lines used	Pin #2 (TD) Transmit Data
	Pin #3 (RD) Receive Data
	Pin #4 (RTS) Request to Send
	Pin #5 (CTS) Clear to Send
	Pin #6 (DSR) Data Set Ready
	Pin #7 (GND) Ground: Signal
	Pin #8 (DCD) Data Carrier Detect
	Pin #20 (DTR) Data Terminal Ready

Data Logging Option

Files Stored	48-interval energy history
	34-day energy history
	34-day override/shed history
Information Reported on	
48-interval history	Time, Peak, KWH used during interval, Temperature on interval boundary
Information Reported on	
34-day history	Date, Peak, Time of Peak, KWH used, Time in Shed, Time Alarm level was exceeded, Minimum and Maximum Temperatures of all connected zones

C. Warranty

Trimax Controls, Incorporated, warrants its shipments to be free from defect in materials and workmanship for a period of one year from the date of shipment from factory. This warranty does not apply to: (1) damage caused by accident, abuse, mishandling, or dropping; (2) units which have been subject to unauthorized repair, (3) units not used in accordance with instructions, and (4) damages exceeding the cost of product.

Trimax Controls, Incorporated, however, assumes no risk or liability for results of the use of its products purchased from it, including but without limiting the generality of the foregoing: (1) the use in combination with any electrical or electronic components, circuits, systems, assemblies, or any other materials or substances; (2) unsuitability of any product for use in any circuit or system; and (3) unreliability due to power line abnormalities or other external sources of interference.

Purchaser's rights under this warranty shall consist solely of requiring Trimax Controls, Incorporated, to repair, or at the discretion of Trimax Controls, Incorporated, replace free of charge, F.O.B. factory, any defective products returned within the warranty period and determined by Trimax Controls, Incorporated, to be defective. The giving of or failure to give any advice or recommendations by Trimax Controls, Incorporated, shall not constitute any warranty by or impose any liability of Trimax Controls, Incorporated. The foregoing constitutes the sole and exclusive remedy of the purchase and the exclusive liability of

Trimax Controls, Incorporated, and is in lieu of any and all other warranties, expressed, implied, or statutory as to merchantability, fitness for purpose sold, description, quality productiveness, or any other matter. IN NO EVENT SHALL TRIMAX CONTROLS, INCORPORATED, BE LIABLE FOR SPECIAL OR CONSEQUENTIAL DAMAGES OR FOR DELAY IN PERFORMANCE OF THIS WARRANTY.

**D. Powersense 830
Program Entry Worksheets**

Program Entry Worksheet Powersense 815/830

FACILITY _____ ENGINEER _____ DATE _____

HOLIDAYS

HOLIDAY NUMBER	DATE	TYPE	NUMBER OF DAYS
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			
25			
26			
27			
28			
29			
30			

SETPOINT

SETPOINT				TEMP COMP SETPOINT		ALARM LEVEL
SETPOINT NUMBER	KW	DEAD-BAND	INTERVAL	BASE TEMP	KW/DEG	KW
1				°F		
2				°F		
3				°F		
4				°F		
5				°F		

OPTIMAL START

ZONE NO.	FUNC.	PRIMARY CIRCUIT	ADDITIONAL CIRCUITS	SETBACK TEMP.	OCCUPIED TEMP.	LOCATION
2	HEAT			°F	°F	
	COOL			°F	°F	
3	HEAT			°F	°F	
	COOL			°F	°F	
4	HEAT			°F	°F	
	COOL			°F	°F	
5	HEAT			°F	°F	
	COOL			°F	°F	
6	HEAT			°F	°F	
	COOL			°F	°F	
7	HEAT			°F	°F	
	COOL			°F	°F	
8	HEAT			°F	°F	
	COOL			°F	°F	

TIMED OVERRIDE

ZONE NUMBER	TIME	CIRCUIT NUMBERS ASSIGNED	LOCATION/DESCRIPTION
1			
2			
3			
4			
5			
6			
7			
8			

DLS TO STD	
STD TO DLS	

Trimax Powerwatch 515M / Powersense 815 / Powersense 830

FACILITY _____ ENGINEER _____ DATE _____

CIRCUIT NUMBER		LOAD DESCRIPTION										PRIORITY NO.			
												MIN SHED			
												MAX SHED			
												MIN ON			
												TEMP. COMP. DUTY CYCLE			
SCHED NO.		MON	TUE	WED	THU	FRI	SAT	SUN	SPEC 1	SPEC 2	DUTY CYCLE	ZONE NUMBER	BASE TEMP.	DEAD BAND	MIN/DEG
1	ON														
	OFF														
2	ON														
	OFF														
3	ON														
	OFF														
4	ON														
	OFF														
5	ON														
	OFF														
6	ON														
	OFF														
7	ON														
	OFF														
8	ON														
	OFF														
9	ON														
	OFF														

FACILITY _____ ENGINEER _____ DATE _____

CIRCUIT NUMBER		LOAD DESCRIPTION										PRIORITY NO.			
												MIN SHED			
												MAX SHED			
												MIN ON			
SCHED NO.		MON	TUE	WED	THU	FRI	SAT	SUN	SPEC 1	SPEC 2	DUTY CYCLE	TEMP. COMP. DUTY CYCLE			
												ZONE NUMBER	BASE TEMP.	DEAD BAND	MIN/DEG
1	ON														
	OFF														
2	ON														
	OFF														
3	ON														
	OFF														
4	ON														
	OFF														
5	ON														
	OFF														
6	ON														
	OFF														
7	ON														
	OFF														
8	ON														
	OFF														
9	ON														
	OFF														

Trimax Powerwatch 515M/Powersense 815/Powersense 830

FACILITY _____ ENGINEER _____ DATE _____

CIRCUIT NUMBER _____												LOAD DESCRIPTION _____				PRIORITY NO. _____			
												MIN SHED _____							
												MAX SHED _____							
												MIN ON _____							
SCHED NO.		MON	TUE	WED	THU	FRI	SAT	SUN	SPEC 1	SPEC 2	DUTY CYCLE	TEMP. COMP. DUTY CYCLE							
												ZONE NUMBER	BASE TEMP.	DEAD BAND	MIN/DEG				
1	ON																		
	OFF																		
2	ON																		
	OFF																		
3	ON																		
	OFF																		
4	ON																		
	OFF																		
5	ON																		
	OFF																		
6	ON																		
	OFF																		
7	ON																		
	OFF																		
8	ON																		
	OFF																		
9	ON																		
	OFF																		

FACILITY _____ ENGINEER _____ DATE _____

CIRCUIT NUMBER _____												LOAD DESCRIPTION _____				PRIORITY NO. _____			
												MIN SHED _____							
												MAX SHED _____							
												MIN ON _____							
SCHED NO.		MON	TUE	WED	THU	FRI	SAT	SUN	SPEC 1	SPEC 2	DUTY CYCLE	TEMP. COMP. DUTY CYCLE							
												ZONE NUMBER	BASE TEMP.	DEAD BAND	MIN/DEG				
1	ON																		
	OFF																		
2	ON																		
	OFF																		
3	ON																		
	OFF																		
4	ON																		
	OFF																		
5	ON																		
	OFF																		
6	ON																		
	OFF																		
7	ON																		
	OFF																		
8	ON																		
	OFF																		
9	ON																		
	OFF																		

Trimax Powerwatch 515M/Powersense 815/Powersense 830

FACILITY _____ ENGINEER _____ DATE _____

CIRCUIT NUMBER		LOAD DESCRIPTION										PRIORITY NO.	MIN SHED	MAX SHED	MIN ON	TEMP. COMP. DUTY CYCLE			
SCHED NO.		MON	TUE	WED	THU	FRI	SAT	SUN	SPEC 1	SPEC 2	DUTY CYCLE	ZONE NUMBER	BASE TEMP.	DEAD BAND	MIN/DEG				
1	ON																		
	OFF																		
2	ON																		
	OFF																		
3	ON																		
	OFF																		
4	ON																		
	OFF																		
5	ON																		
	OFF																		
6	ON																		
	OFF																		
7	ON																		
	OFF																		
8	ON																		
	OFF																		
9	ON																		
	OFF																		

FACILITY _____ ENGINEER _____ DATE _____

CIRCUIT NUMBER		LOAD DESCRIPTION										PRIORITY NO.			
												MIN SHED			
SCHED NO.												MIN ON			
												TEMP. COMP.			
		MON	TUE	WED	THU	FRI	SAT	SUN	SPEC 1	SPEC 2	DUTY CYCLE	ZONE NUMBER	BASE TEMP.	DEAD BAND	MIN/DEG
1	ON														
	OFF														
2	ON														
	OFF														
3	ON														
	OFF														
4	ON														
	OFF														
5	ON														
	OFF														
6	ON														
	OFF														
7	ON														
	OFF														
8	ON														
	OFF														
9	ON														
	OFF														

Trimax Powerwatch 515M/Powersense 815/Powersense 830

FACILITY _____ ENGINEER _____ DATE _____

CIRCUIT NUMBER _____		LOAD DESCRIPTION _____										PRIORITY NO. _____			
												MIN SHED _____			
												MAX SHED _____			
												MIN ON _____			
SCHED NO.		MON	TUE	WED	THU	FRI	SAT	SUN	SPEC 1	SPEC 2	DUTY CYCLE	TEMP. COMP. DUTY CYCLE			
												ZONE NUMBER	BASE TEMP.	DEAD BAND	MIN/DEG
1	ON														
	OFF														
2	ON														
	OFF														
3	ON														
	OFF														
4	ON														
	OFF														
5	ON														
	OFF														
6	ON														
	OFF														
7	ON														
	OFF														
8	ON														
	OFF														
9	ON														
	OFF														

FACILITY _____ ENGINEER _____ DATE _____

CIRCUIT NUMBER _____		LOAD DESCRIPTION _____										PRIORITY NO. _____			
												MIN SHED _____			
												MAX SHED _____			
												MIN ON _____			
SCHED NO.		MON	TUE	WED	THU	FRI	SAT	SUN	SPEC 1	SPEC 2	DUTY CYCLE	TEMP. COMP. DUTY CYCLE			
												ZONE NUMBER	BASE TEMP.	DEAD BAND	MIN/DEG
1	ON														
	OFF														
2	ON														
	OFF														
3	ON														
	OFF														
4	ON														
	OFF														
5	ON														
	OFF														
6	ON														
	OFF														
7	ON														
	OFF														
8	ON														
	OFF														
9	ON														
	OFF														

Trimax Powerwatch 515M/Powersense 815/Powersense 830

FACILITY _____ ENGINEER _____ DATE _____

CIRCUIT NUMBER _____ LOAD DESCRIPTION _____											PRIORITY NO. _____				
											MIN SHED _____				
											MAX SHED _____				
											MIN ON _____				
											TEMP. COMP. DUTY CYCLE				
SCHED NO.		MON	TUE	WED	THU	FRI	SAT	SUN	SPEC 1	SPEC 2	DUTY CYCLE	ZONE NUMBER	BASE TEMP.	DEAD BAND	MIN/DEG
1	ON														
	OFF														
2	ON														
	OFF														
3	ON														
	OFF														
4	ON														
	OFF														
5	ON														
	OFF														
6	ON														
	OFF														
7	ON														
	OFF														
8	ON														
	OFF														
9	ON														
	OFF														

FACILITY _____ ENGINEER _____ DATE _____

CIRCUIT NUMBER _____ LOAD DESCRIPTION _____											PRIORITY NO. _____				
											MIN SHED _____				
											MAX SHED _____				
											MIN ON _____				
											TEMP. COMP. DUTY CYCLE				
SCHED NO.		MON	TUE	WED	THU	FRI	SAT	SUN	SPEC 1	SPEC 2	DUTY CYCLE	ZONE NUMBER	BASE TEMP.	DEAD BAND	MIN/DEG
1	ON														
	OFF														
2	ON														
	OFF														
3	ON														
	OFF														
4	ON														
	OFF														
5	ON														
	OFF														
6	ON														
	OFF														
7	ON														
	OFF														
8	ON														
	OFF														
9	ON														
	OFF														

Trimax Powerwatch 515M/Powersense 815/Powersense 830

FACILITY _____ ENGINEER _____ DATE _____

CIRCUIT NUMBER _____ LOAD DESCRIPTION _____												PRIORITY NO. _____			
												MIN SHED _____			
												MAX SHED _____			
												MIN ON _____			
SCHED NO.		MON	TUE	WED	THU	FRI	SAT	SUN	SPEC 1	SPEC 2	DUTY CYCLE	TEMP. COMP. DUTY CYCLE			
												ZONE NUMBER	BASE TEMP.	DEAD BAND	MIN/DEG
1	ON														
	OFF														
2	ON														
	OFF														
3	ON														
	OFF														
4	ON														
	OFF														
5	ON														
	OFF														
6	ON														
	OFF														
7	ON														
	OFF														
8	ON														
	OFF														
9	ON														
	OFF														

FACILITY _____ ENGINEER _____ DATE _____

CIRCUIT NUMBER _____ LOAD DESCRIPTION _____												PRIORITY NO. _____			
												MIN SHED _____			
												MAX SHED _____			
												MIN ON _____			
SCHED NO.		MON	TUE	WED	THU	FRI	SAT	SUN	SPEC 1	SPEC 2	DUTY CYCLE	TEMP. COMP. DUTY CYCLE			
												ZONE NUMBER	BASE TEMP.	DEAD BAND	MIN/DEG
1	ON														
	OFF														
2	ON														
	OFF														
3	ON														
	OFF														
4	ON														
	OFF														
5	ON														
	OFF														
6	ON														
	OFF														
7	ON														
	OFF														
8	ON														
	OFF														
9	ON														
	OFF														

Trimax Powerwatch 515M/Powersense 815/Powersense 830

FACILITY _____ ENGINEER _____ DATE _____

CIRCUIT NUMBER _____		LOAD DESCRIPTION _____										PRIORITY NO. _____			
												MIN SHED _____			
												MAX SHED _____			
												MIN ON _____			
SCHED NO.		MON	TUE	WED	THU	FRI	SAT	SUN	SPEC 1	SPEC 2	DUTY CYCLE	TEMP. COMP. DUTY CYCLE			
												ZONE NUMBER	BASE TEMP.	DEAD BAND	MIN/DEG
1	ON														
	OFF														
2	ON														
	OFF														
3	ON														
	OFF														
4	ON														
	OFF														
5	ON														
	OFF														
6	ON														
	OFF														
7	ON														
	OFF														
8	ON														
	OFF														
9	ON														
	OFF														

FACILITY _____ ENGINEER _____ DATE _____

CIRCUIT NUMBER _____		LOAD DESCRIPTION _____										PRIORITY NO. _____			
												MIN SHED _____			
												MAX SHED _____			
												MIN ON _____			
SCHED NO.		MON	TUE	WED	THU	FRI	SAT	SUN	SPEC 1	SPEC 2	DUTY CYCLE	TEMP. COMP. DUTY CYCLE			
												ZONE NUMBER	BASE TEMP.	DEAD BAND	MIN/DEG
1	ON														
	OFF														
2	ON														
	OFF														
3	ON														
	OFF														
4	ON														
	OFF														
5	ON														
	OFF														
6	ON														
	OFF														
7	ON														
	OFF														
8	ON														
	OFF														
9	ON														
	OFF														

FACILITY _____ ENGINEER _____ DATE _____															
CIRCUIT NUMBER _____		LOAD DESCRIPTION _____										PRIORITY NO. _____			
												MIN SHED _____			
												MAX SHED _____			
												MIN ON _____			
SCHED NO.		MON	TUE	WED	THU	FRI	SAT	SUN	SPEC 1	SPEC 2	DUTY CYCLE	TEMP. COMP. DUTY CYCLE			
												ZONE NUMBER	BASE TEMP.	DEAD BAND	MIN/DEG
1	ON														
	OFF														
2	ON														
	OFF														
3	ON														
	OFF														
4	ON														
	OFF														
5	ON														
	OFF														
6	ON														
	OFF														
7	ON														
	OFF														
8	ON														
	OFF														
9	ON														
	OFF														

FACILITY _____ ENGINEER _____ DATE _____

CIRCUIT NUMBER		LOAD DESCRIPTION										PRIORITY NO.			
												MIN SHED		MAX SHED	
SCHED NO.												MIN ON			
												TEMP.			
		MON	TUE	WED	THU	FRI	SAT	SUN	SPEC 1	SPEC 2	DUTY CYCLE	ZONE NUMBER	BASE TEMP.	DEAD BAND	MIN/DEG
1	ON														
	OFF														
2	ON														
	OFF														
3	ON														
	OFF														
4	ON														
	OFF														
5	ON														
	OFF														
6	ON														
	OFF														
7	ON														
	OFF														
8	ON														
	OFF														
9	ON														
	OFF														

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FACILITY _____ ENGINEER _____ DATE _____

CIRCUIT NUMBER _____		LOAD DESCRIPTION _____										PRIORITY NO. _____			
												MIN SHED _____			
												MAX SHED _____			
												MIN ON _____			
SCHED NO.		MON	TUE	WED	THU	FRI	SAT	SUN	SPEC 1	SPEC 2	DUTY CYCLE	TEMP. COMP. DUTY CYCLE			
												ZONE NUMBER	BASE TEMP.	DEAD BAND	MIN/DEG
1	ON														
	OFF														
2	ON														
	OFF														
3	ON														
	OFF														
4	ON														
	OFF														
5	ON														
	OFF														
6	ON														
	OFF														
7	ON														
	OFF														
8	ON														
	OFF														
9	ON														
	OFF														

FACILITY _____ ENGINEER _____ DATE _____

CIRCUIT NUMBER _____		LOAD DESCRIPTION _____										PRIORITY NO. _____			
												MIN SHED _____			
												MAX SHED _____			
												MIN ON _____			
SCHED NO.		MON	TUE	WED	THU	FRI	SAT	SUN	SPEC 1	SPEC 2	DUTY CYCLE	TEMP. COMP. DUTY CYCLE			
												ZONE NUMBER	BASE TEMP.	DEAD BAND	MIN/DEG
1	ON														
	OFF														
2	ON														
	OFF														
3	ON														
	OFF														
4	ON														
	OFF														
5	ON														
	OFF														
6	ON														
	OFF														
7	ON														
	OFF														
8	ON														
	OFF														
9	ON														
	OFF														

Trimax Powerwatch 515M/ Powersense 815/ Powersense 830

FACILITY _____ ENGINEER _____ DATE _____

CIRCUIT NUMBER		LOAD DESCRIPTION										PRIORITY NO.			
												MIN SHED			
												MAX SHED			
												MIN ON			
SCHED NO.		MON	TUE	WED	THU	FRI	SAT	SUN	SPEC 1	SPEC 2	DUTY CYCLE	TEMP. COMP. DUTY CYCLE			
												ZONE NUMBER	BASE TEMP.	DEAD BAND	MIN/DEG
1	ON														
	OFF														
2	ON														
	OFF														
3	ON														
	OFF														
4	ON														
	OFF														
5	ON														
	OFF														
6	ON														
	OFF														
7	ON														
	OFF														
8	ON														
	OFF														
9	ON														
	OFF														

FACILITY _____ ENGINEER _____ DATE _____

CIRCUIT NUMBER		LOAD DESCRIPTION										PRIORITY NO.			
												MIN SHED			
SCHED NO.												MIN ON			
												TEMP.			
		MON	TUE	WED	THU	FRI	SAT	SUN	SPEC 1	SPEC 2	DUTY CYCLE	ZONE NUMBER	BASE TEMP.	DEAD BAND	MIN/DEG
1	ON														
	OFF														
2	ON														
	OFF														
3	ON														
	OFF														
4	ON														
	OFF														
5	ON														
	OFF														
6	ON														
	OFF														
7	ON														
	OFF														
8	ON														
	OFF														
9	ON														
	OFF														

[illegible]FACILITY _____ ENGINEER _____ DATE _____

CIRCUIT NUMBER		LOAD DESCRIPTION										PRIORITY NO.			
												MIN SHED			
												MAX SHED			
												MIN ON			
SCHED NO.		MON	TUE	WED	THU	FRI	SAT	SUN	SPEC 1	SPEC 2	DUTY CYCLE	TEMP. COMP. DUTY CYCLE			
												ZONE NUMBER	BASE TEMP.	DEAD BAND	MIN/DEG
1	ON														
	OFF														
2	ON														
	OFF														
3	ON														
	OFF														
4	ON														
	OFF														
5	ON														
	OFF														
6	ON														
	OFF														
7	ON														
	OFF														
8	ON														
	OFF														
9	ON														
	OFF														

[illegible]FACILITY _____ ENGINEER _____ DATE _____

CIRCUIT NUMBER		LOAD DESCRIPTION										PRIORITY NO.			
												MIN SHED			
												MAX SHED			
												MIN ON			
												TEMP. COMP. DUTY CYCLE			
SCHD NO.		MON	TUE	WED	THU	FRI	SAT	SUN	SPEC 1	SPEC 2	DUTY CYCLE	ZONE NUMBER	BASE TEMP	DEAD BAND	MIN/DEG
1	ON														
	OFF														
2	ON														
	OFF														
3	ON														
	OFF														
4	ON														
	OFF														
5	ON														
	OFF														
6	ON														
	OFF														
7	ON														
	OFF														
8	ON														
	OFF														
9	ON														
	OFF														

FACILITY _____		ENGINEER _____		DATE _____											
CIRCUIT NUMBER _____	LOAD DESCRIPTION _____								PRIORITY NO. _____						
									MIN SHED _____						
									MAX SHED _____						
									MIN ON _____						
SCHED NO.		MON	TUE	WED	THU	FRI	SAT	SUN	SPEC 1	SPEC 2	DUTY CYCLE	TEMP. COMP. DUTY CYCLE			
												ZONE NUMBER	BASE TEMP.	DEAD BAND	MIN/DEG
1	ON														
	OFF														
2	ON														
	OFF														
3	ON														
	OFF														
4	ON														
	OFF														
5	ON														
	OFF														
6	ON														
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7	ON														
	OFF														
8	ON														
	OFF														
9	ON														
	OFF														

FACILITY _____ ENGINEER _____ DATE _____

CIRCUIT NUMBER _____		LOAD DESCRIPTION _____										PRIORITY NO. _____			
												MIN SHED _____			
												MAX SHED _____			
												MIN ON _____			
SCHED NO.		MON	TUE	WED	THU	FRI	SAT	SUN	SPEC 1	SPEC 2	DUTY CYCLE	TEMP. COMP. DUTY CYCLE			
												ZONE NUMBER	BASE TEMP.	DEAD BAND	MIN/DEG
1	ON														
	OFF														
2	ON														
	OFF														
3	ON														
	OFF														
4	ON														
	OFF														
5	ON														
	OFF														
6	ON														
	OFF														
7	ON														
	OFF														
8	ON														
	OFF														
9	ON														
	OFF														

Document Title: _____

Dear User:

Please take a minute to complete an evaluation of this publication. Your comments will be carefully reviewed, helping us to continually improve the quality of the documentation you use.

Is this manual easy to use? Why or why not? _____

Are there errors or contradictions in this manual? _____

What additional features would increase the usefulness of this manual? _____

Is this manual readable? ... logically organized? _____

Additional comments? _____

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9.8.12 TEMPERATURE COMPENSATED SETPOINT Report

If the Demand Control and Temperature Input Options have been installed in the Powersense 830, the user may request the Temperature Compensated Setpoint information for one or more setpoints. (A Multiple Setpoint Option must also be installed to generate this information for setpoints 2-5.) An example of this report is shown in Figure 9.17.

CHECK FUNCTION? TS

7:05P STD THURSDAY 3/11/82

SETPOINT NO.	BASE TEMP	KW/ DEG
1	45	5
2	40	10
3	35	15
4	30	20
5	25	25

Figure 9.17: TSP Report

Operating in almost the same manner as for the Temperature Compensated Duty Cycle function, the demand level for a selected setpoint moves up or down as a function of the outside temperature. For more details, refer to Chapter 4 of this manual.

9.8.13 STD/DLS Report

To check the date at which Daylight Savings Time will switch over to Standard Time, the user can check the date by entering STD. The system responds with:

DLS TO STD ON 10/31/82

Conversely, to check the crossover date from Standard Time to Daylight Savings time, the user simply enters DLS and the response is:

STD TO DLS ON 4/25/82

9.8.14 ALARM Report

If the Demand Control Option has been installed in the Powersense 830, the user can check the alarm level for Setpoint No. 1. With the Multiple Setpoint Option installed, up to five alarm levels can be reported for the corresponding setpoints as shown in Figure 9.18. Typing ALA in response to CHECK FUNCTION? or ALL, SCHED requests the alarm report.

CHECK FUNCTION? ALA

7:06P STD THURSDAY 3/11/82

SETPOINT NO.	ALARM LEVEL
1	1000
2	1300
3	1100
4	1200
5	1000

Figure 9.18: ALARM Report

9.9 CHANGE

The user must invoke the CHANGE function to initially program the Powersense 830, to change individual schedule information currently residing in the energy management system, or to cancel schedule information.

Programming is essentially the same as when using the Powersense 830 front panel. The user may enter/change data in a FULL or ABBREVIATED dialogue. Figure 9.19 summarizes the FULL Enter/Change dialogue while Figure 9.20 provides the abbreviated Enter/Change dialogue. Figure 9.21 and 9.22 provide the FULL and ABBREV Cancel dialogue. The "user response" data entered in the tables is for example purposes only. The user should respond with the programming data appropriate for his or her scheduling needs. User entries are underlined for purposes of clarity.

To enter the CHANGE function:

STATUS, CHECK, CHANGE, OR HISTORY? CHA

PASSWORD? _ _ _ _

FULL OR ABBREV MODE? F (or A)

Figure 9.19: Full Dialogue (ENTER/CHANGE)

FUNCTION	CHANGE MNEMONIC/ User Enters	PROMPT EXAMPLE	USER RESPONSE	NOTES
Clock	Clock <u>CL</u>	TIME? DAY? STD/DLS? DATE? ENTER?	803A MON DLS 80283 Y	
Schedule	SCHED <u>SC</u>	CIRCUIT NO.? SCHEDULE NO.? ON? OFF? DAYS? ENTER?	1 3 800A 515P M-F,SAT,S1 Y	
Timer (Zone Zero)	TIMER <u>TI</u>	ZONE? CIRCUIT NO(S)? TIME? ENTER?	0 3,5 200 Y	max.10 circuits
TIMED OVERRIDE (Zones 1-8)	TIMER <u>TI</u>	ZONE? CIRCUIT NO(S)? TIME? ENTER?	1 4,6 145 Y	If Timed Override Option installed max. 10 circuits

Figure 9.19: continued

DUTY CYCLE	DU/CY <u>DU</u>	CIRCUIT NO.?	1	
		SCHEDULE NO.?	1	
		ON?	45	
		OFF?	15	
		ENTER?	Y	
HOLIDAY	HOLIDAY <u>H</u>	HOLIDAY NO.?	5	
		TYPE?	2	
		DATE?	90783	
		NO. DAYS?	3	
		ENTER?	Y	
SETPOINT	SET <u>SE</u>			ERROR if Demand Card not installed
		SETPOINT NO.?	1	Prompt returned only if Multiple Setpoint Card installed
		KILOWATTS?	1200	
		DEADBAND?	200	
		INTERVAL?	15	
		ENTER?	Y	
CIRCUIT PRIORITY	PRIOR <u>P</u>			ERROR if Demand card not installed
		CIRCUIT NO.?	5	
		NUMBER?	7	
		ENTER?	Y	
MIN/MAX SHED MINIMUM ON	MIN <u>MI</u>	CIRCUIT NOS.?	7,8	
		MIN SHED?	5	
		MAX SHED?	20	
		MIN ON?	8	
		ENTER?	Y	
OPTIMAL START	OPT <u>O</u>			ERROR if temperature card not installed
		ZONE?	3	
		CIRCUIT NOS?	1,3,9,17	First circuit number entered is primary circuit
		SETBACK TEMP?	55	Setback < OCCUP for cooling -- Setback > OCCUP for heating
		OCCUP TEMP?	72	
		ENTER?	Y	

Figure 9.19: continued

TEMPERATURE	TDC	ERROR if Temperature	
COMPENSATED	TD	card not installed	
DUTY CYCLE			
		CIRCUIT NO.?	2
		SCHEDULE NO.?	2
		ZONE?	5
		BASE TEMP?	75
		DEADBAND?	5
		MIN/DEG?	2
		ENTER?	Y
TEMPERATURE	TSP	ERROR if Temperature	
COMPENSATED	TS	Card not installed	
SETPOINT			
		SETPOINT NO.?	1 Prompt given if Multiple Setpoint Card is installed
		BASE TEMP?	45
		KW/DEG?	5
		ENTER?	Y
STANDARD	STD	DATE?	102583
TIME	SI	ENTER?	Y
DAYLIGHT	DLS	DATE?	42583
SAVINGS TIME	DL	ENTER?	Y
ALARM LEVEL	ALARM	ERROR if Demand Card	
	A	not installed	
		SETPOINT?	1 Prompt given only if Multiple Setpoint Card is installed
		KILOWATTS?	700
		ENTER?	Y

For CLOCK, the user enters up to four digits, the time desired based on a 12-hour clock. The time is immediately followed by either an A or P to distinguish A.M. or P.M. After entering the proper day of the week and the time standard, the user must then

enter up to six digits for the current month/day/year/ (mmddyy). A leading zero for the month can be omitted; however, a zero is required for the day if earlier than the 10th (i.e., 70482).

The user may use SCHED to change the ON/OFF times for a schedule of a specified circuit by responding to the prompts with the desired circuit and schedule number. Then the new ON/OFF times for the schedule are entered. If the schedule is to be changed for the entire week, M-F can be entered instead of designating each day individually.

TIMER can be used to change the temporary time extension value for Zone 0 (zero) circuits or set timed override values for up to eight remote momentary contact switches (i.e., pushbuttons) in Zones 1-8.

The DUTY CYCLE function allows the user to change the ON/OFF times for a schedule of a specified circuit by responding to the prompts with the desired circuit and schedule number.

The user may change a variety of information for one or more individual setpoints. (A Multiple Setpoint Option Card is required for the SETPOINT NO.? prompt.) The user may change the setpoint value by entering the number of kilowatts in response to

the KILOWATTS? prompt. The LEADEND is an offset to be subtracted from the setpoint value. The value should be equal to the user's largest sheddable load multiplied by a factor of 1.5. This information may also be changed by entering a new value. A new value for INTERVAL -- the sliding window used to average and predict demand -- may also be entered. The value in minutes may be from 0-59, 100 (100 = 1 hour).

A new priority under either a fixed or rotating scheme can be entered for a circuit by requesting the PRIORITY function. The circuit is designated by a 1- or 2-digit number and the new priority is entered in response to NUMBER?

The MIN/MAX SHED times and the MINIMUM ON time for one or more circuits can be entered or changed through the MIN/MAX function. Circuits are designated by a 1- or 2-digit number. The MIN/MAX SHED times and MINIMUM ON times are given in hours and minutes.

A variety of information may be entered for the OPTIMAL START function. As Zone 1 is the temperature thermistor used to record the external temperature, the user must enter a ZONE number from 2-8 (or 2-4) as desired. The SETBACK and OCCUP temperatures can then be changed for a designated circuit and schedule. The SETBACK TEMP is the temperature (degrees Fahrenheit) at which the

facility will be maintained when not occupied. The OCCUP TEMP is the desired facility temperature for the optimal start program to achieve by the start of business.

The TEMPERATURE COMPENSATED DUTY CYCLE function allows the user to vary the duty cycle pattern as a function of either inside or outside temperature. After designating the CIRCUIT, SCHEDULE and ZONE numbers, the user enters a BASE TEMP (degrees Fahrenheit), DEADBAND, and a minutes per degree value (MIN/DEG).

The TEMPERATURE COMPENSATED SETPOINT function operates in the same manner. The SETPOINT NO.? prompt will be given only if a Multiple Setpoint Option Card has been installed in the Powersense 830. The user enters an outside temperature value (degrees Fahrenheit) in response to BASE TEMP. KW/DEG asks for the number of additional kilowatts to be added to the setpoint value per degree of variance from the BASE TEMP value. A value of 5 adds 5 kilowatts to the setpoint level for every degree registered above or below the external BASE TEMP value.

To set the date for a cross-over to or from Standard Time to Daylight Savings Time, the user enters a 5- or 6-digit number, with 2 digits each representing the month, day and year. The leading zero for the month can be omitted.

When the setpoint demand level is changed for a given setpoint, its corresponding ALARM must also be changed. The user may change the Alarm Level by entering the appropriate responses to the ALARM prompts.

As shown in Figure 9.2.2 data may be entered or changed without the use of prompts. The abbreviated user dialogue allows the user to input data on one line. Each entry is separated from the next entry by a slash "/" sign. The "user response" data is only an example. The user must respond with the data required for his desired programming.

Figure 9.20: Abbreviated Dialogue (ENTER/CHANGE)

FULL OR ABBREVIATED MODE? <u>A</u>	
------------------------------------	--

PROMPT/RESPONSE	FUNCTION
COMMAND? CL/803A/MON/DLS/80283	CLOCK
COMMAND? SC/1/3/800A/515P/M-F,SAT,S1	SCHEDULE
COMMAND? TI/0/3,5/200	TIMER (Zone Zero)
COMMAND? TI/1/4,6/145	TIMED OVERRIDE (Zones 1-8)
COMMAND? DU/1/1/45/15	DUTY CYCLE
COMMAND? HO/5/2/90783/3	HOLIDAY
COMMAND? SE/1/1200/200/15	SETPOINT
COMMAND? PR/5/7	SHED PRIORITY
COMMAND? MI/7,8/5/20/8	MIN/MAX SHED-MIN ON
COMMAND? OP/3/13,9,7/55/72	OPTIMAL START
COMMAND? TD/2/2/3/75/5/2	TEMPERATURE COMP. DUTY CYCLE
COMMAND? TS/1/45/5	TEMPERATURE COMP. SETPOINT
COMMAND? ST/102583	STANDARD TIME
COMMAND? DL/42583	DALIGHT SAVINGS TIME
COMMAND? AL/1/700	ALARM LEVEL

Figures 9.21 and 9.22 show the full and abbreviated user dialogues used to cancel current program information. The user response data is primarily shown as an example. The user must respond with the data that corresponds to the information he wishes to cancel.

Figure 9.21: Full Dialogue (CANCEL)

FULL OR ABBREV MODE? <u>F</u>				
	CHANGE MNEMONIC/	PROMPT	USER	
<u>FUNCTION</u>	<u>User Enters</u>	<u>EXAMPLE</u>	<u>RESPONSE</u>	<u>NOTES</u>
Schedule	SCHED	CIRCUIT NO.?	1	Cancel one on/off schedule of specified circuit on given day
	<u>SC</u>	SCHEDULE NO.?	1	
		ON?	CAN	
		DAYS?	MON,TUE,SAT	
		ENTER?	Y	
		CIRCUIT NO.?	<C/R>	
		-- OR --		
	<u>SC</u>	CIRCUIT NO.?	CAN	Cancel all 9 on/off schedules on given day
		CIRCUIT NO.?	5,7,9	Up to 10 circuits
		DAYS?	M-F,Si	
Timer (Zone Zero)	TIMER	ZONE?	0	
	<u>TI</u>	CIRCUIT NO(S)?	CAN	
		ENTER?	Y	
		CHANGE FUNCTION?	<Function> or <C/R>	
TIMED OVERRIDE (Zones 1-8)	TIMER	ZONE?	1	If Timed Override Option installed
	<u>TI</u>	CIRCUIT NO(S)?	CAN	
		ENTER?	Y	
		CHANGE FUNCTION?	<Function> or <C/R>	

Figure 9.21: continued

DUTY CYCLE			
	<u>DU</u>	CIRCUIT NO.?	1 Cancel a single Duty Cycle of one circuit
		SCHEDULE NO.?	1
		ON?	CAN
		ENTER?	Y
		-- OR --	
	<u>DU</u>	CIRCUIT NO.?	CAN Cancel all 9 Duty Cycle schedules of all designated ckts
		CIRCUIT NOS.?	7,8,9 Up to 10 circuits
		ENTER?	Y
		CIRCUIT NO.?	<C/R>
HOLIDAY			
	<u>HOLIDAY</u> <u>H</u>	HOLIDAY NO.?	5
		TYPE?	CAN
		ENTER?	Y
		HOLIDAY NO.?	<C/R>
		CHANGE FUNCTION?	<Function> or <C/R>
SETPOINT			
	<u>SET</u> <u>SE</u>	SETPOINT NO.?	1 Prompt returned only if Multiple Setpoint Card installed
		KILOWATTS?	CAN
		ENTER?	Y
		SETPOINT NO.?	<C/R>
		CHANGE FUNCTION?	<Function> or <C/R>
Shed PRIORITY			
	<u>PRIOR</u> <u>PR</u>	CIRCUIT NO.?	5
		NUMBER?	CAN
		ENTER?	Y
		CIRCUIT NO.?	<C/R>
		CHANGE FUNCTION?	<Function> or <C/R>
MIN/MAX SHED MINIMUM ON			
	<u>MIN</u> <u>MI</u>	CIRCUIT NOS.?	7,8
		MIN SHED?	CAN
		ENTER?	Y
		CHANGE FUNCTION?	<Function> or <C/R>

Figure 9.21: Continued

OPTIMAL START	OPT <u>OP</u>	ZONE? CIRCUIT NOS? ENTER? CHANGE FUNCTION?	3 CAN Y <Function> or <C/R>
TEMPERATURE COMPENSATED DUTY CYCLE	TDC <u>TD</u>	CIRCUIT NO.? SCHEDULE NO.? ZONE? ENTER? CIRCUIT NO.? CHANGE FUNCTION?	2 2 CAN Y <C/R> <Function> or <C/R>
TEMPERATURE COMPENSATED SETPOINT	TSP <u>TS</u>	SETPOINT NO.? BASE TEMP? ENTER? SETPOINT NO.? CHANGE FUNCTION?	1 Prompt given if Multiple Setpoint Card is installed CAN Y <C/R> <Function> or <C/R>
STANDARD TIME	STD <u>ST</u>	DATE? ENTER? CHANGE FUNCTION?	102583 Y <Function> or <C/R>
DAYLIGHT SAVINGS TIME	DLS <u>DL</u>	DATE? ENTER? CHANGE FUNCTION?	42583 Y <Function> or <C/R>
ALARM LEVEL	ALARM <u>A</u>	SETPOINT? KILOWATTS? ENTER? SETPOINT? CHANGE FUNCTION?	1 Prompt given only if Multiple Setpoint Card is installed CAN Y <C/R> <Function> or <C/R>

Figure 9.22: Abbreviated Dialogue (CANCEL)

FULL OR ABBREVIATED MODE? <u>A</u>	
PROMPT/RESPONSE	FUNCTION
COMMAND? SC/1/1/CAN/MON,TUE,SAT	SCHEDULE (CANCEL ONE SCHED FOR DESIGNATED CKT)
COMMAND? SC/CAN/5,7,10/M-F,S1	SCHEDULE (CANCEL ALL NINE SCHEDULES FOR CKT)
COMMAND? TI/0/CAN	TIMER (Zone Zero)
COMMAND? TI/1/CAN	TIMED OVERRIDE (Zones 1-8)
COMMAND? DU/1/1/CAN	DUTY CYCLE (CANCEL ONE SCHED)
COMMAND? DU/CAN/7,8,10	DUTY CYCLE (CANCEL ALL SCHEDS FOR SELECT CKTS)
COMMAND? HO/1/CAN	HOLIDAY
COMMAND? SE/5/CAN	SETPOINT
COMMAND? PR/5/CAN	SHED PRIORITY
COMMAND? MI/7,8/CAN	MIN/MAX SHED-MIN ON
COMMAND? OP/3/CAN	OPTIMAL START
COMMAND? TD/2/2/CAN	TEMPERATURE COMP. DUTY CYCLE
COMMAND? TS/1/CAN	TEMPERATURE COMP. SETPOINT
COMMAND? ST/CAN	STANDARD TIME
COMMAND? DL/CAN	DAYLIGHT SAVINGS TIME
COMMAND? AL/1/CAN	ALARM LEVEL
COMMAND? PE/CAN	DEMAND PEAK

9.10 Sign-Off Procedures

There are two procedures the user may follow to sign off or terminate the communications dialogue.

The dialogue can be terminated by pressing the ESC key on the keyboard at any stage during the telecommunications. The 830 will then instruct the modem to hang-up and return to the on-hook condition. This is the preferred method for sign-off.

It is also possible to simply hang up the telephone at the terminal end of the telephone line without pressing the ESC key. The auto-answer modem will then recognize that the connection has been broken and will automatically return to the "on-hook" condition.

X Data Logging Option

When fitted with the Data Logging Option, the Powersense 830 continuously stores historical data regarding energy usage and indoor/outdoor temperatures for the facility under control. The Serial Communication Option is required in order to output the information stored in the Data Logging memory.

10.1 Installation

The Data Logging Option Card (Figure 10.1) has a bracket for clipping and holding its own 9V alkaline battery. The battery should be connected before installing the card. When depleted, this battery will also initiate the LOW BATTERY alarm on the front panel. It is recommended that both batteries be changed whenever the LOW BATTERY light begins to flash.

To install the Data Logging Option Card, remove power to the 830 or depress and hold the RESET button, then insert the card into Slot F. Note that there is no corresponding terminal block F and no additional wiring is required.

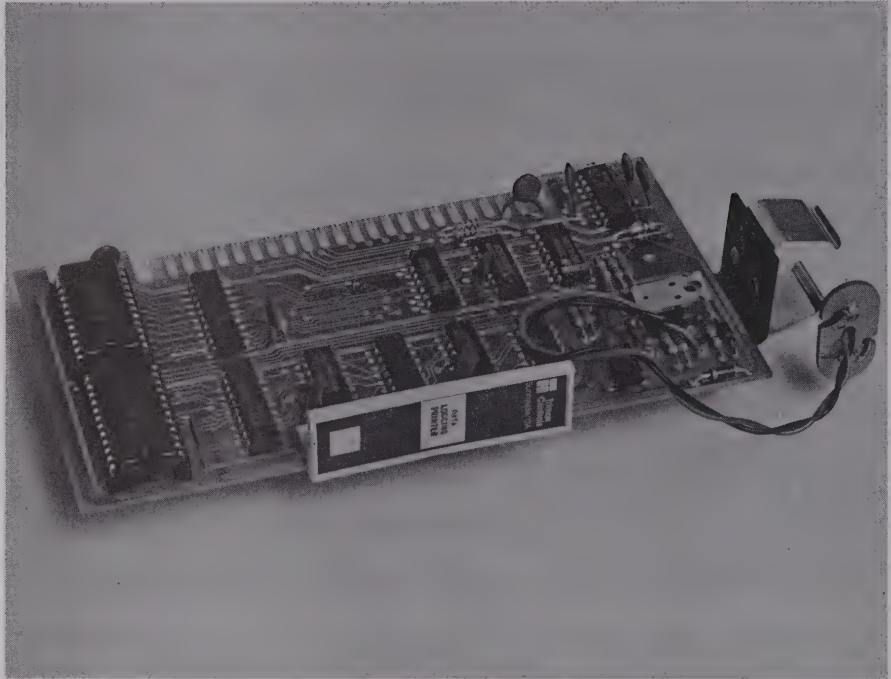


Figure 10.1: Data Logging Option Card

There are three files of history maintained in the Data Logging memory: 48-Interval Energy History, 34-Day Energy History and 34-Day Override/Shed History.

The history information is accessed by responding with "HISTORY" to the STATUS line prompt:

STATUS, CHECK, CHANGE, OR HISTORY? H

If the Data Logging Option is not installed, the terminal returns an ERROR message. If present, a second prompt line will be returned:

INTERVAL, DAILY, OR OVERRIDE/SHED?

The user responds depending on the history data desired (e.g., "I", "D", or "O").

The history function simply provides a printout of the stored historical data. There is no access function that allows this data to be changed or cancelled. There are, however, two functions available through the Serial Communication Option which allow selection of the interval duration for the 48 interval file and designations of the types of data to be collected and stored in the Override/Shed file.

 Note

When first powering up the Powersense 830, the system clock must be set (see Chapter 2) before the Data Logging Option will begin storing data.

10.2 Interval Energy History

Figure 10.2 shows the report generated for the 48-Interval Energy History.

This file stores entries for 48 individual intervals. Discontinuity in reporting will be experienced if the user changes the Powersense 830 clock or if there is a power failure.

Under the TIME heading, 48 consecutive entries of interval information can be listed, with the most current time first. The information for each entry is calculated on the boundary between intervals.

The time at the end of a reporting interval is listed in the left hand column under the heading TIME. The peak demand that occurred during the interval (e.g., 12:45P - 1:00P) is listed under the PEAK heading next to the (1:00P) TIME entry. The kilowatt hours

STATUS, CHECK, CHANGE, OR HISTORY? H

INTERVAL, DAILY, OR OVERRIDE/SCHED? I

48 INTERVAL ENERGY HISTORY

4:52P DLS FRIDAY 6/17/83

TIME	PEAK	KWH	ZONE1	ZONE2	ZONE3	ZONE4	ZONE5	ZONE6	ZONE7	ZONE8
4:45P	836	199	81	76	76	76	82	83	82	117
4:30P	866	185	85	76	76	76	82	83	82	118
4:15P	844	211	82	76	76	76	82	82	82	118
4:00P	872	204	83	76	76	75	82	82	81	118
3:45P	958	217	84	76	76	76	82	81	81	117
3:30P	974	219	82	75	76	76	82	81	81	117
3:15P	958	233	84	75	76	75	82	81	82	117
3:00P	958	240	83	75	76	75	82	81	82	117
2:45P	1000	210	83	76	76	76	81	81	81	116
2:30P	998	243	81	75	76	75	81	81	81	116
2:15P	1006	247	83	76	76	75	81	81	81	117
2:00P	1005	211	79	75	75	75	81	80	81	116
1:45P	963	241	79	75	76	74	81	80	81	117
1:30P	968	236	77	75	76	75	81	80	82	118
1:15P	908	193	77	75	76	75	81	80	82	117
1:00P	932	230	75	75	76	75	81	81	82	117
12:45P	941	193	76	76	76	75	81	81	81	118
12:30P	839	209	76	75	76	75	82	82	81	117
12:15P	877	194	74	75	75	75	83	82	81	118
12:00A	858	214	76	75	76	75	82	82	81	118
11:45A	978	205	75	76	76	74	81	81	81	117
11:30A	969	224	71	76	76	75	80	80	80	118
11:15A	1033	245	70	74	76	74	79	80	80	117
11:00A	940	235	68	74	75	75	79	79	80	117
10:45A	928	216	69	75	76	74	79	79	79	117
10:30A	954	207	69	75	75	75	78	79	79	118
10:15A	940	235	69	74	76	74	78	78	78	117
10:00A	891	209	69	74	75	74	77	77	78	118
9:45A	918	225	69	74	75	74	77	77	78	118
9:30A	793	198	67	75	74	73	76	76	77	117
9:15A	920	199	69	74	74	72	75	75	76	118
9:00A	906	227	66	73	73	71	75	75	76	117
8:45A	909	201	65	73	73	70	75	74	75	118
8:30A	863	216	63	72	73	69	75	75	75	117
8:15A	824	165	62	73	73	68	74	74	74	118
8:00A	836	207	61	73	73	68	73	73	74	117
7:45A	543	136	60	72	73	69	73	73	74	117
7:30A	396	93	59	72	73	69	73	73	74	118
7:15A	396	99	59	72	73	71	73	73	74	117
7:00A	448	85	58	73	73	71	73	73	74	117
6:45A	445	111	57	73	73	73	73	73	75	117
6:30A	369	88	57	73	73	73	73	73	75	117
6:15A	268	67	57	73	74	73	73	73	74	117
6:00A	262	55	56	73	74	73	73	73	74	118
5:45A	401	67	55	73	74	74	73	73	75	117
5:30A	401	100	54	74	74	74	73	73	75	118
5:15A	467	78	56	74	74	74	74	74	75	117
5:00A	575	119	56	74	75	74	74	74	75	118

Figure 10.2: 48 Interval Energy History

consumed by the facility during the interval are reported under the KWH heading. The ZONE column reports the zone temperatures at the time specified.

Upon power-up, the 830 assumes a reporting interval of one hour. Data collection is then performed hourly until 48 entries (covering the most recent 48 hours) have been stored. Thereafter, the oldest entry is deleted and a new one is added thus maintaining a "rolling" 48 hour history.

If desired, the reporting interval can be changed (through the Serial Communication Option only) to any value between 4 minutes and 99 hours, 59 minutes. Regardless of the interval selected, the 830 maintains only 48 entries in the Interval File. (Selection of a 4 minute reporting interval will allow logging of the most recent 192 minutes [4x48] or 3 hours, 12 minutes)..

The interval may be modified by selecting the CHANGE mode as described in Chapter 9, Serial Communications Option. To make the change, use either the full or abbreviated mode as explained below.

1) Using FULL dialogue:

FULL OR ABBREV MODE? F

SCHED,DU/CY,.....?

HI

OVERRIDE, SHED, OR INTERVAL? IN

INTERVAL? 15

ENTER? Y

OVERRIDE, SHED, OR INTERVAL? <RETURN>

CHANGE FUNCTION?

2) Using ABBREVIATED dialogue:

FULL OR ABBREV MODE? A

COMMAND? HI/IN/15

COMMAND? <RETURN>

STATUS, CHECK, CHANGE, OR HISTORY?

Both examples above show the procedure for setting the reporting interval to 15 minutes. To select a different value, simply replace the 15 with the desired interval in the range of 4 minutes to 99 hours, 59 minutes. Remember that all entries must be in hours and minutes (100 = 1 hour, 130 = 1 hour, 30 minutes).

There are no provisions for CHECKING the interval previously entered. Rather, this can be determined by requesting a 48-interval report and subtracting any two consecutive entries.

10.3 34-Day Energy History

Figure 10.3 shows the format for the 34-Day Energy History Report.

This file is updated daily at midnight. As such, the date of the current day is not listed at the top of the 34 entries (since the day is not yet complete). All information reported for each line is based on midnight-to-midnight observations by the 830. As with the Interval File, the oldest entry is deleted at midnight in order to make room for the new entry covering the most recent day.

The example in figure 10.3 shows the information for a portion of the 34-day period. The information is stored and printed with the most recent day at the top of the report. Note that under the heading DATE, the most current date recorded is listed first followed by the remaining date entries in descending order.

Note

If there is a power outage or if the user changes the clock, there may be discontinuity in the reporting dates.

INTERVAL,DAILY, OR OVERRIDE/SHED? D

4:54P DLS FRIDAY 6/17/83

34 DAY ENERGY HISTORY

DATE	PEAK	TIME OF PEAK	KWH USED	TIME IN SHED	TIME IN ALRM	ZONE1 MN MX	ZONE2 MN MX	ZONE3 MN MX	ZONE4 MN MX	ZONE5 MN MX	ZONE6 MN MX	ZONE7 MN MX	ZONE8 MN MX
616	1248	320P	13160	0	0	55102	72 85	73 83	70 84	72 92	72 93	74 92	921161118
615	1279	455P	14083	1	0	56 97	71 86	71 83	71 86	71 88	71 87	73 87	1121118
614	1095	415P	13016	0	0	56 88	71 80	73 80	72 82	73 82	73 82	75 81	1051118
613	1298	422P	13321	0	0	50103	67 86	71 82	70 86	69 91	69 91	71 91	1117118
612	567	847P	4951	0	0	48 93	68 86	68 83	68 86	67 86	67 86	69 85	117118
611	520	500A	5284	0	0	52 85	67 83	68 80	68 84	68 82	68 82	70 82	117118
610	1093	535P	12276	0	0	53 88	70 78	70 76	69 78	69 84	69 84	71 84	116118
609	1089	304P	12102	0	0	51 81	69 81	69 78	60 81	68 83	68 82	68 81	114117
608	1143	325P	12103	0	0	56 87	73 78	72 78	72 79	73 83	72 82	72 83	84116
607	1218	1135A	12309	0	0	61 90	74 82	73 82	74 85	76 86	75 85	78 87	98123
606	1375	407P	15412	36	0	58106	73 83	73 83	73 83	74 95	74 93	75 94	122123
605	710	545P	6976	0	0	55103	70 86	71 86	71 86	70 91	70 90	72 89	123123
604	562	500A	7446	0	0	53 91	69 86	69 83	69 86	69 86	69 85	71 85	107123
603	1128	349P	12942	0	0	54 90	69 82	69 79	69 81	69 83	68 82	70 83	100118
602	1020	318P	12387	0	0	52 90	69 77	70 75	68 78	66 78	66 78	68 78	104112
601	936	331P	12397	0	0	53 82	69 77	70 75	68 77	68 79	68 78	69 79	104112
531	897	445P	11567	0	0	54 76	69 77	69 76	69 76	69 78	69 78	71 80	111115
530	215	1156P	4258	0	0	49 87	67 83	67 81	67 84	66 82	66 82	68 82	101116
529	537	725A	4805	0	0	54 79	68 82	69 79	69 83	69 80	69 80	71 80	111115
528	475	445A	4946	0	0	56 82	70 79	71 78	71 79	71 81	71 81	72 81	112116
527	1050	305P	10778	0	0	55 89	71 83	71 80	70 83	71 83	71 83	72 83	104115
526	1088	1217P	11888	0	0	53 87	70 84	70 80	70 80	70 82	70 83	72 83	112116
525	982	502P	11708	0	0	54 85	70 84	70 81	70 83	70 82	70 82	71 82	112116
524	1063	228P	12349	0	0	55 82	69 82	70 79	70 80	70 81	70 81	72 81	113121
523	1110	334P	13823	6	0	55 81	71 78	72 78	71 78	72 81	72 81	74 81	115122
522	513	725A	5366	0	0	56 89	72 86	72 85	73 86	73 87	73 87	75 86	119122
521	556	459A	6380	0	0	56 94	73 86	74 84	71 86	73 89	73 88	75 88	116122
520	1220	129P	13565	0	0	57105	74 86	74 87	75 89	73 94	73 93	75 92	116122
519	1213	506P	9235	0	0	65104	74 86	75 87	76 90	79 92	80 91	80 90	110122
606	1375	407P	300800	43	0								

Figure 10.3: 34 Day Energy History Report

The demand peak as well as the time it occurred for the day appear under the subsequent headings PEAK and TIME OF PEAK. The highest peak and the date of the demand peak for the history period are printed in the bottom TOTAL line. The time at which the peak occurred is listed at the bottom of the TIME OF PEAK column.

KWH USED shows the amount of kilowatt hours used for each individual day and the kilowatt hour usage for the reporting period is totalled at the column end.

TIME IN SHED reports the cumulative time (in hours and minutes) that at least one circuit was shed for the day. The total amount of time that loads have been shed for the reporting period is totalled at the bottom of the report.

TIME IN ALARM reports the cumulative time that the ALARM LEVEL was exceeded (i.e., alarm level light flashing on front panel).

The remainder of the report (ZONE 1/MN MX, etc.) provides the minimum and maximum temperatures observed for the designated zone on the specified date.

10.4 34-Day Override/Shed History

The 34-day Override/Shed History file retains one of two types of data as designated via the Serial Communication Option:

1) OVERRIDE FILE -- In this mode the Model 830 will record and maintain a 34 day history of overrides on a circuit-by-circuit basis. As shown in Figure 10.4, the report lists circuit numbers across the top of the page and the dates vertically down the page (most recent date first). The times given are in hours and minutes and reflect the accumulated time that the circuit should have been OFF but was overridden ON due to one or more of the following:

- Timer
- Timed override option
- Remote ON override
- Manual ON override via CLOSED/OPEN/AUTO switch
on circuit master card
- ON indication from Remote Load Sense Feature
when circuit is scheduled OFF

INTERVAL, DAILY, OR OVERRIDE/SHED? D

34 DAY OVERRIDE HISTORY

4:56P DLS FRIDAY 6/17/83

DATE	1	2	4	5	6	11	12	13	14	15	16	19	26
616	0	0	0	0	0	0	0	0	0	0	0	0	0
615	0	0	0	0	0	0	0	0	0	0	0	0	0
614	0	0	0	0	0	0	0	0	0	0	0	0	0
613	0	0	0	0	0	0	0	0	0	0	0	0	0
612	0	0	0	0	0	0	0	0	0	0	0	0	0
611	0	0	0	0	0	0	0	0	0	0	0	0	0
610	0	0	0	0	0	0	0	0	0	0	0	0	0
609	0	0	0	0	0	0	0	0	0	0	0	0	0
608	0	0	0	0	0	0	0	0	0	0	0	0	0
607	0	0	0	0	0	0	0	0	0	0	0	0	200
606	0	0	0	0	0	0	0	0	0	0	0	0	0
605	0	0	0	0	0	0	0	0	0	0	0	0	0
604	0	0	0	0	0	0	0	0	0	0	0	0	0
603	0	0	0	0	0	0	0	0	0	0	0	0	0
602	0	0	0	0	0	0	0	0	0	0	0	0	0
601	0	0	0	0	0	0	0	0	0	0	0	0	0
531	0	0	0	0	0	626	627	627	627	0	0	0	0
530	0	0	0	0	0	651	600	600	550	200	0	0	0
529	0	0	0	0	0	0	0	0	0	0	0	0	0
528	0	0	0	0	0	0	0	0	0	0	0	0	0
527	0	0	0	0	0	0	0	0	0	0	0	0	0
526	0	0	0	28	302	0	0	0	0	0	0	0	0
525	0	0	0	0	0	0	0	0	0	0	0	0	23
524	0	0	0	0	0	0	0	0	0	0	1	0	0
523	0	0	0	0	0	0	0	0	0	0	0	0	0
522	0	0	0	0	0	0	0	1	1	0	0	2	0
521	0	0	0	0	0	0	0	0	0	0	0	0	0
520	0	0	0	0	0	0	0	0	0	0	0	0	0
519	24	34	35	0	0	37	38	39	40	0	0	310	0
TOTAL	24	34	35	28	302	1354	1305	1307	1258	200	1	312	223

Figure 10.4: 34 Day Override History

Overrides that result in switching the circuit from ON to OFF are not tallied by the override file.

Upon initial power-up, the 830 assumes the override file mode and begins to store override data.

2) SHED FILE -- The 830 can be instructed to maintain a circuit-by-circuit shed history file for the most recent 34 days. The format is identical to that of the override file with the only difference being the title of the report. The shed file maintains a daily total (in hours and minutes) of the time that each circuit was shed by the demand control option.

As mentioned earlier, the format of the override and shed reports is identical. Each covers the most recent 34 days with the totals at the bottom of each column reflecting the cumulative time that a circuit was overridden or shed. The report will be printed in two sections, if during the last 34 days the system has tabulated data for more than 15 circuits.

 Note

The Model 830 Data Logging Option can be configured to log only one type of data (override or shed) at a time. Instructing the system to change from one type to the other will erase all previous data stored in the 34-day Override/Shed File. The 34-day Energy History File will remain intact.

The procedure for changing from logging overrides to logging shed activity is as follows:

- 1) Using FULL dialogue:

FULL OR ABBREV MODE? F

SCHED, DU/CY,.....?

HI

OVERRIDE, SHED, OR INTERVAL? OV (or SH to select shed)

ENTER? Y

OVERRIDE, SHED, OR INTERVAL? <RETURN>

CHANGE FUNCTION?

2) Using ABBREVIATED mode:

FULL OR ABBREV MODE? A

COMMAND? HI/OV (or HI/SH to select shed)

COMMAND? <RETURN>

As with the 48-interval file, it is not possible to perform any CHECK operation in order to determine which file has been selected. Requesting an OVERRIDE/SHED report in response to the INTERVAL, DAILY, OR OVERRIDE/SHED? prompt will produce a report for the selected mode. The title of the report will indicate the type of data logged.

XI IN CASE OF DIFFICULTY

Your Powersense 830 was fully tested and verified to be completely operational prior to shipment from the Trimax factory. In the event that operational difficulties are experienced, the first step should be to determine whether the problem is internal or external to the Trimax unit. If the difficulty lies within the Model 830, it can be corrected by the replacement of one of the following modules:

- Front Panel Assembly
- Power Supply Assembly
- Circuit Master Card
- Serial Communication Option Card
- Demand Input Pulse Option Card
- Demand Input Analog Option Card
- Data Logging Option Card
- Multiple Setpoint Option Card
- Timed Override Option Card
- Temperature Input Option Card

This chapter is intended to serve as a guide to isolation of difficulties within the Powersense 830. It is organized into 3 sections:

1. Operation of Diagnostics
2. Detailed Troubleshooting Flowcharts
3. Returning equipment to the Trimax
Factory

Several of the most commonly encountered problems are listed below for quick reference:

If a circuit switches ON or OFF at the improper time or on the wrong day, use CHECK to review the stored schedule information against the prepared (written) schedule list (especially schedules 2-9 of the offending circuit). Also, review the circuit's duty cycle schedule and status of TIMER. Check to see if a holiday has been entered on the wrong day.

If a circuit will not switch ON or OFF when scheduled, check the Circuit Status Indicators for a flashing light indicating an override condition. Check the Circuit Master Card CLOSED/OPEN/AUTO switch setting.

Also, check for presence of remote override switch closures, if connected. If no flashing lights occur, check the 2 amp fuse on the Circuit Master Card for the circuit in question.

If a circuit switches ON when scheduled OFF (or vice versa), check the setting of the configuration switches on the Circuit Master Card and check for correct connection to the N/O or N/C contact of the control relay. Cards are normally shipped from Trimax configured for fail-on operation.

Check all control wiring, any equipment safety switches, and relays for defects. Also, check both control power sources and the primary power supply. If the Remote Load Sense feature is selected on any circuits, check the associated wiring and switches.

If the ALARM light flashes and no other lights on the front panel are flashing, the problem is related to the Pulse Input Demand Card (i.e., a Form A pulse initiating meter is used and you have not removed the blue JU1 jumper from the card).

This section cannot handle every difficulty which may occur, but serves as a guide to some common problems and what you can do to attempt recovery of the system. If you have a problem with the Powersense 830 which you cannot resolve, call the Trimax Field Service Department at (800) 538-1884 [California, Alaska, and Hawaii: (408) 737-0950].

11.1 Operation of System Diagnostics

CAUTION

OPERATION OF THE POWERSENSE 830 DIAGNOSTICS WILL CAUSE LOSS OF ALL PROGRAMS RESIDENT IN THE UNIT (i.e., ON/OFF SCHEDULES, DUTY CYCLE VALUES, SETPOINTS, ETC.).
Operate the diagnostic only if you are prepared to completely re-enter all of your programs upon completion of the diagnostic check.

The diagnostic test checks the system's internal memory and the front panel lights and displays, and allows you to ensure that each key is functioning correctly.

Follow the sequence below to perform the main Powersense diagnostic test:

1) Open the front panel. On the backside of the panel, above the block of configuration switches, locate a push button switch labeled TEST.

2) Press TEST. You will need a thin instrument to accomplish this as the button is covered by a black shield with 2 small holes. The test button is behind the lower of the 2 holes. When the button is pressed, the front panel display will freeze.

3) Locate switch number 4 on the configuration switch block, which will initiate the diagnostic program, and switch it ON (toward the number 4) and then OFF.

The automatic portion of the Powersense 830 diagnostic check takes anywhere from 90 to 120 seconds to execute. If the diagnostic check is successful, all LEDs and front panel lights will light, and the displays will be filled with 8s. You should be able to tell if any front panel light is burned out, or any display is defective.

4) To test the data entry and function keys, press each one. Each key has a number (0 to 31) assigned to it which should appear in the middle display window. Data entry keys 1-9 and 0 display their own numbers. The other keys are numbered as follows:

STD/AM = 10	SCHED = 16
DLS/PM = 11	CLOCK = 17
NEXT = 12	TIMER = 18
ENTER = 13	CHECK = 19
CANCEL = 14	
CLEAR = 15	etc.

It is not important which number is assigned to which key, but that pressing each key in succession produces a different numerical display. If one of the keys does not, contact Trimax Field Service Department.

 Note

Before pressing RESET, manually override any circuits that you wish to remain ON or OFF.

- 5) Press the RESET button (behind upper of 2 holes on black shield).
- 6) Re-enter program information.

11.2 Troubleshooting Flowcharts

The troubleshooting flowcharts in this segment of the manual are designed to facilitate fault isolation within the Powersense 830. Use of the flowcharts is straightforward and logical; they are designed such that a reasonably careful individual with limited electronics background can isolate faults to one of the replaceable modules listed at the beginning of this chapter.



All test measurements should be taken with a digital voltmeter or a Simpson 260 series VOM or equivalent (20,000 ohm/volt DC, 5,000 ohm/volt AC).

➡ CAUTION

Static electric discharge may result in damage to internal systems. Before touching any electronic components, touch the outside of the grounded case to discharge any static electricity you may be carrying.

➡ CAUTION

When making voltage checks, exercise care so as not to short circuit any adjacent electronic components with the test probe.

The application of each flowchart is explained in the paragraphs below:

830 DISPLAY: This flowchart should be used if the front panel display is blank or appears to be incorrect. The numbers along the right side indicate that the procedure is to be followed on another page, starting with the corresponding number on the appropriate page. The troubleshooting procedure for the front panel display begins in the upper left corner of the flowchart.

VOLTAGE CHECK: Start in the upper left corner of this chart in the box labeled "ALL LED'S OUT?". (Note: Other pages in this section may refer you to entry points 2-5). The diamonds along the left side of the chart refer to the row of red lights on the backside of the Model 830 front door. The voltage check points are located to the left of these LED'S and are labeled +12, -12, +24, etc (see Figure 11.1). All voltage measurements requested in the procedure should be performed with the negative (-) black lead connected to the test point labeled GND.

830 CIRCUIT MASTER CARD (CMC): Follow this procedure for any difficulties encountered with the operation of the Circuit Master Cards.

DEMAND INPUT PULSE CARD

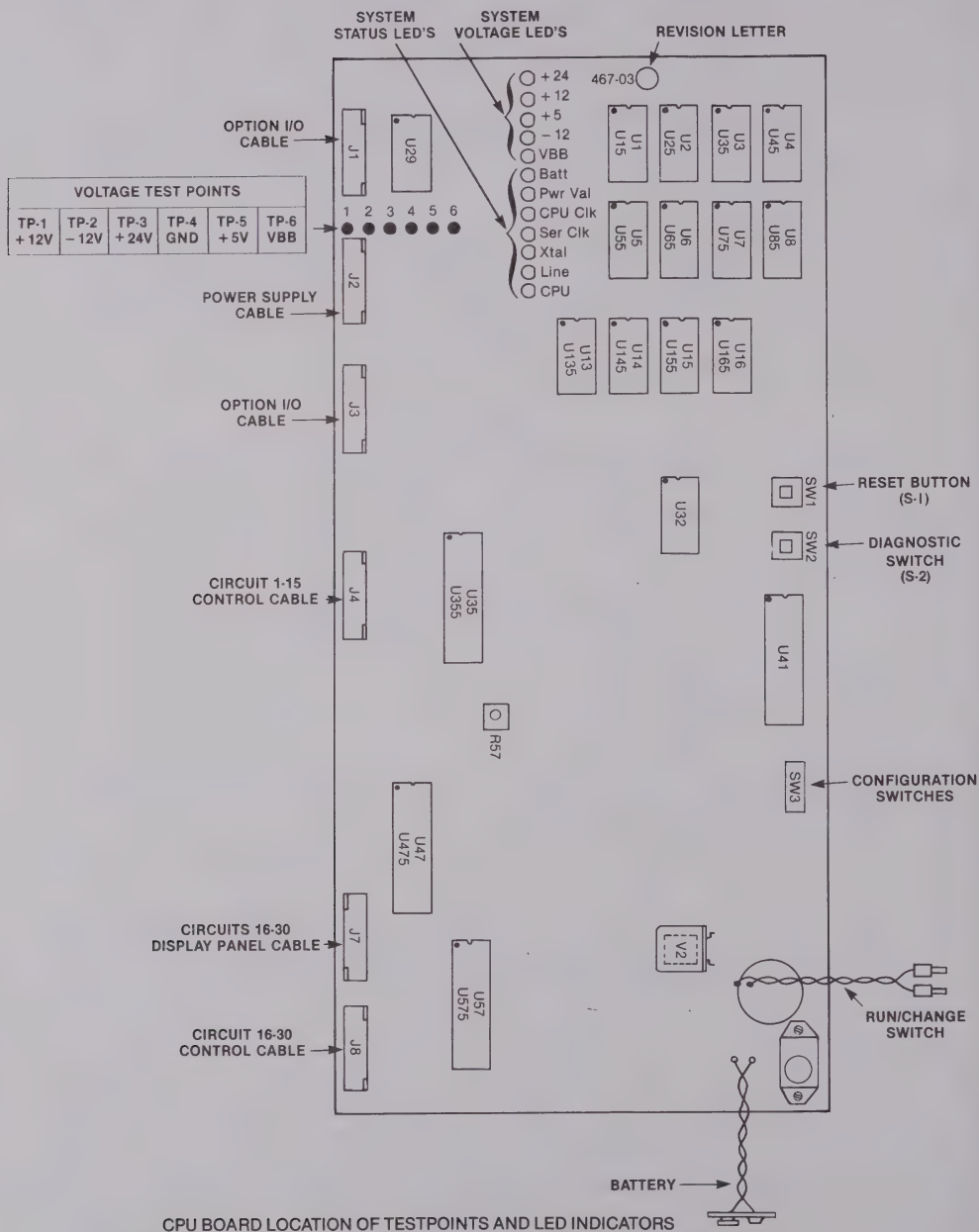
DEMAND INPUT ANALOG CARD

TEMPERATURE INPUT OPTION

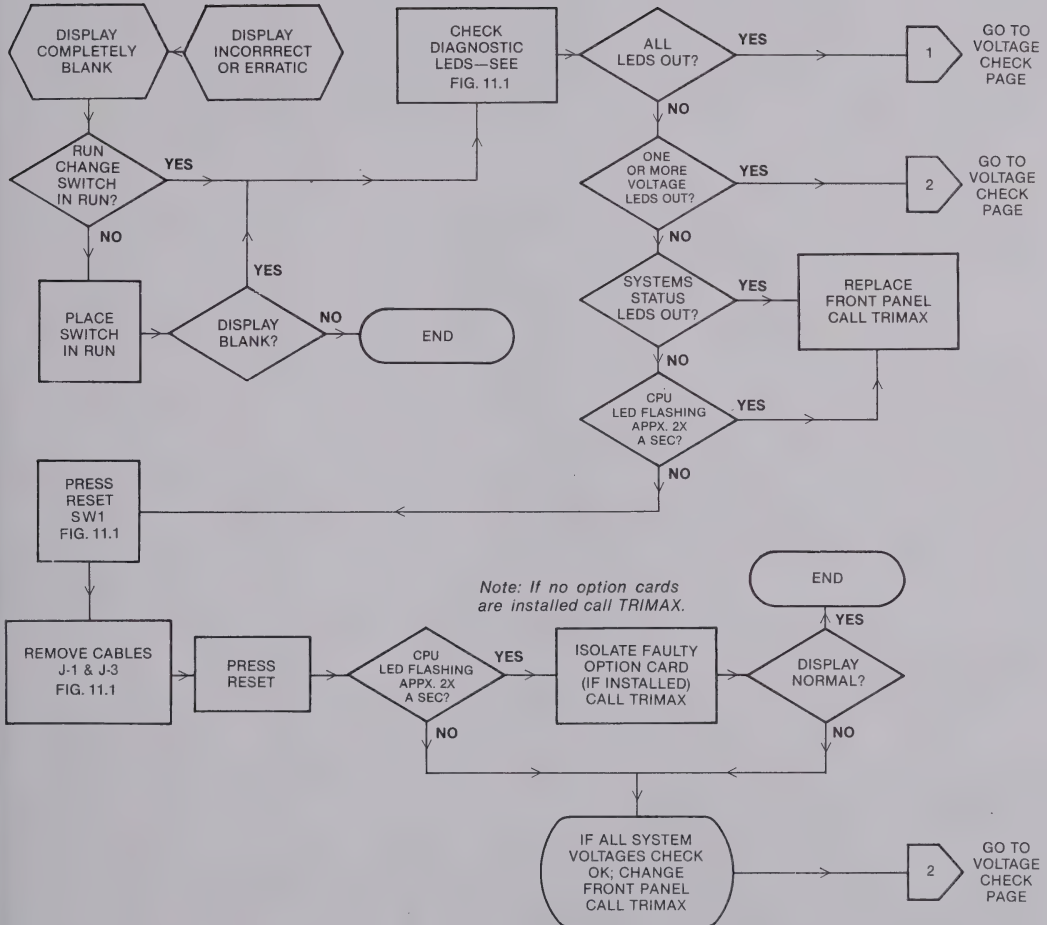
SERIAL COMMUNICATION OPTION:

These printed circuit cards are options and may not be present in the unit you are troubleshooting. Locate and follow the appropriate flowcharts for the option card in question.

Figure 11.1:



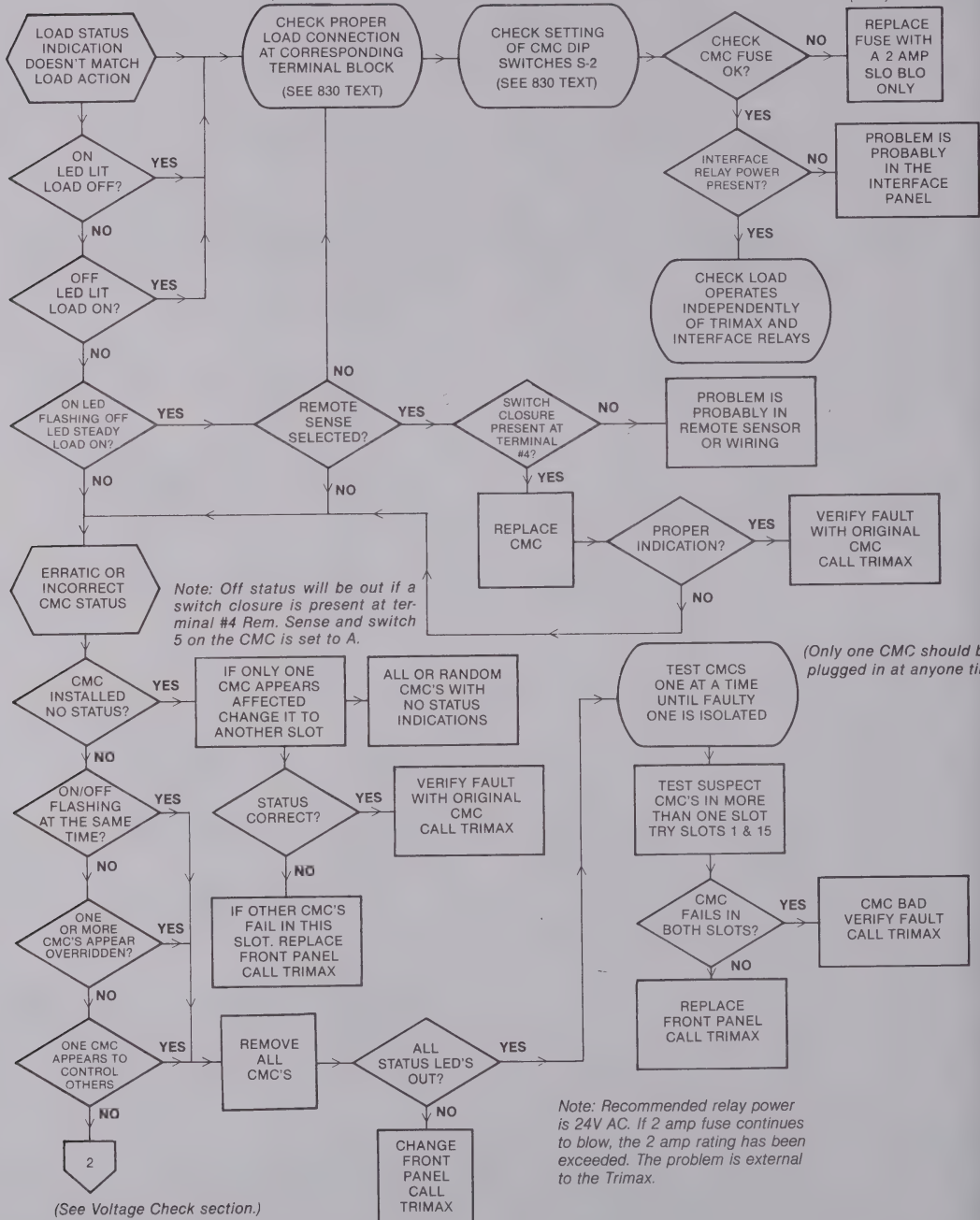
830 Display



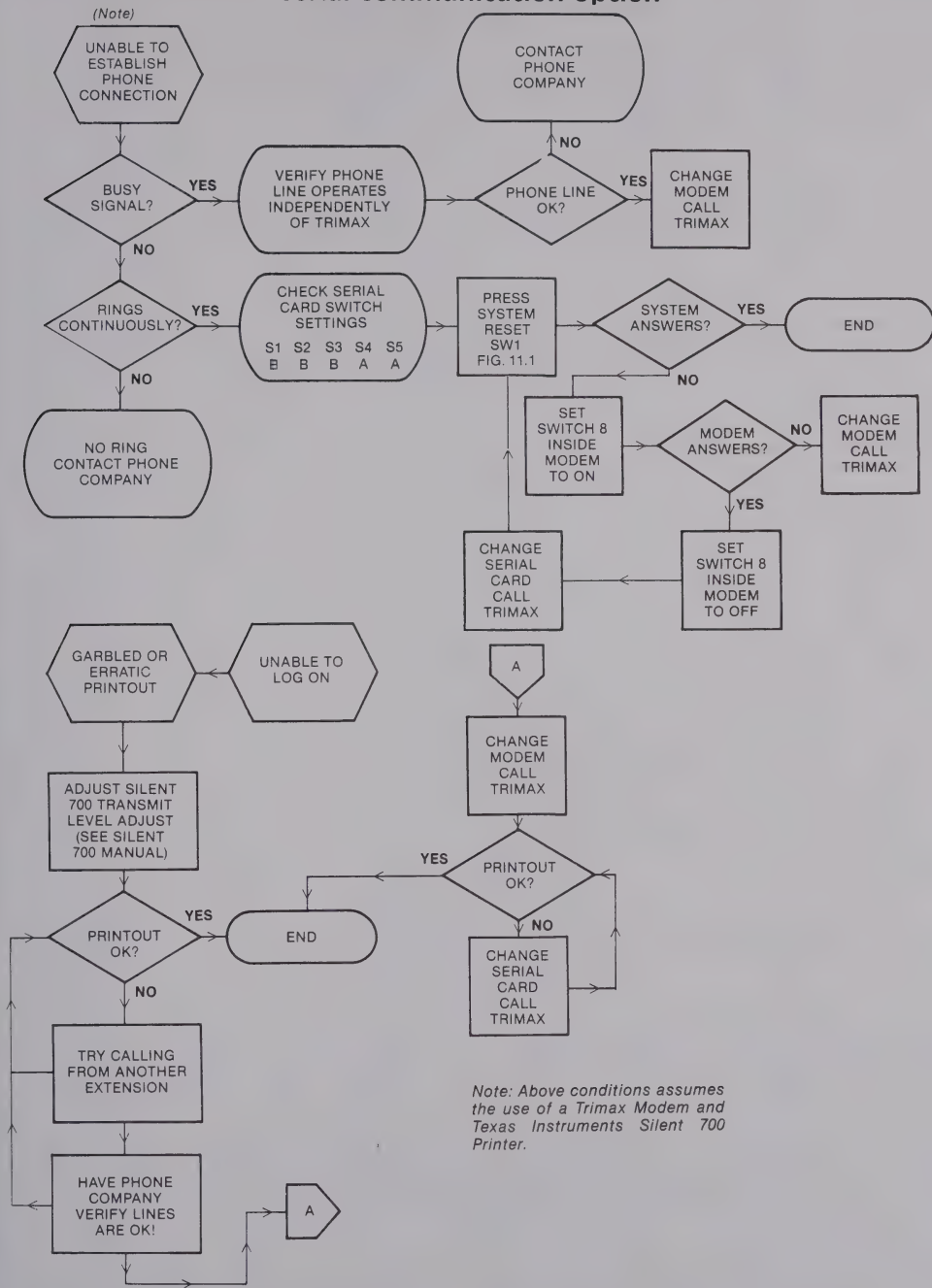
830 Circuit Master Card (CMC)

(All CMC's should be programmed on, with override in auto)

(Note)

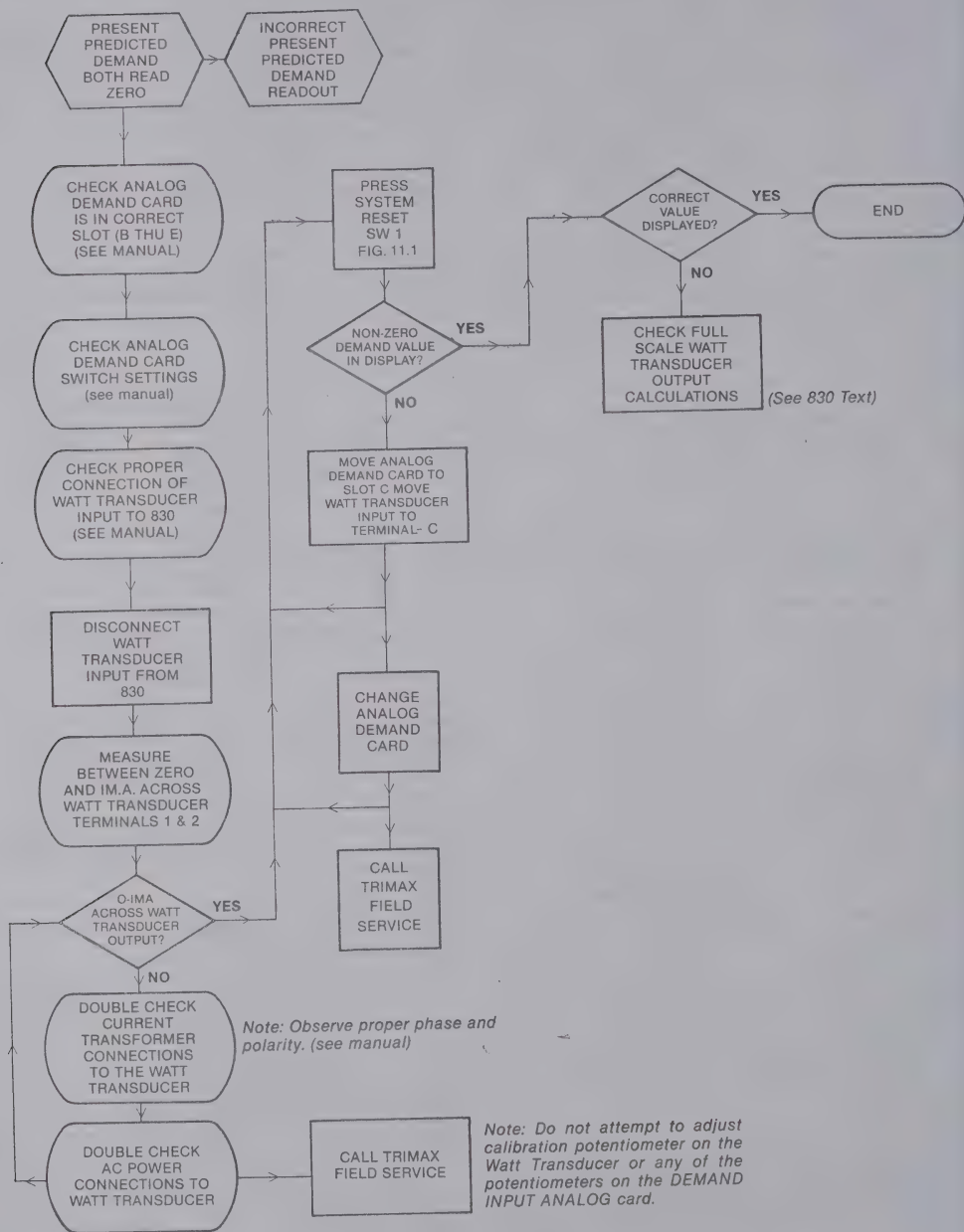


Serial Communication Option



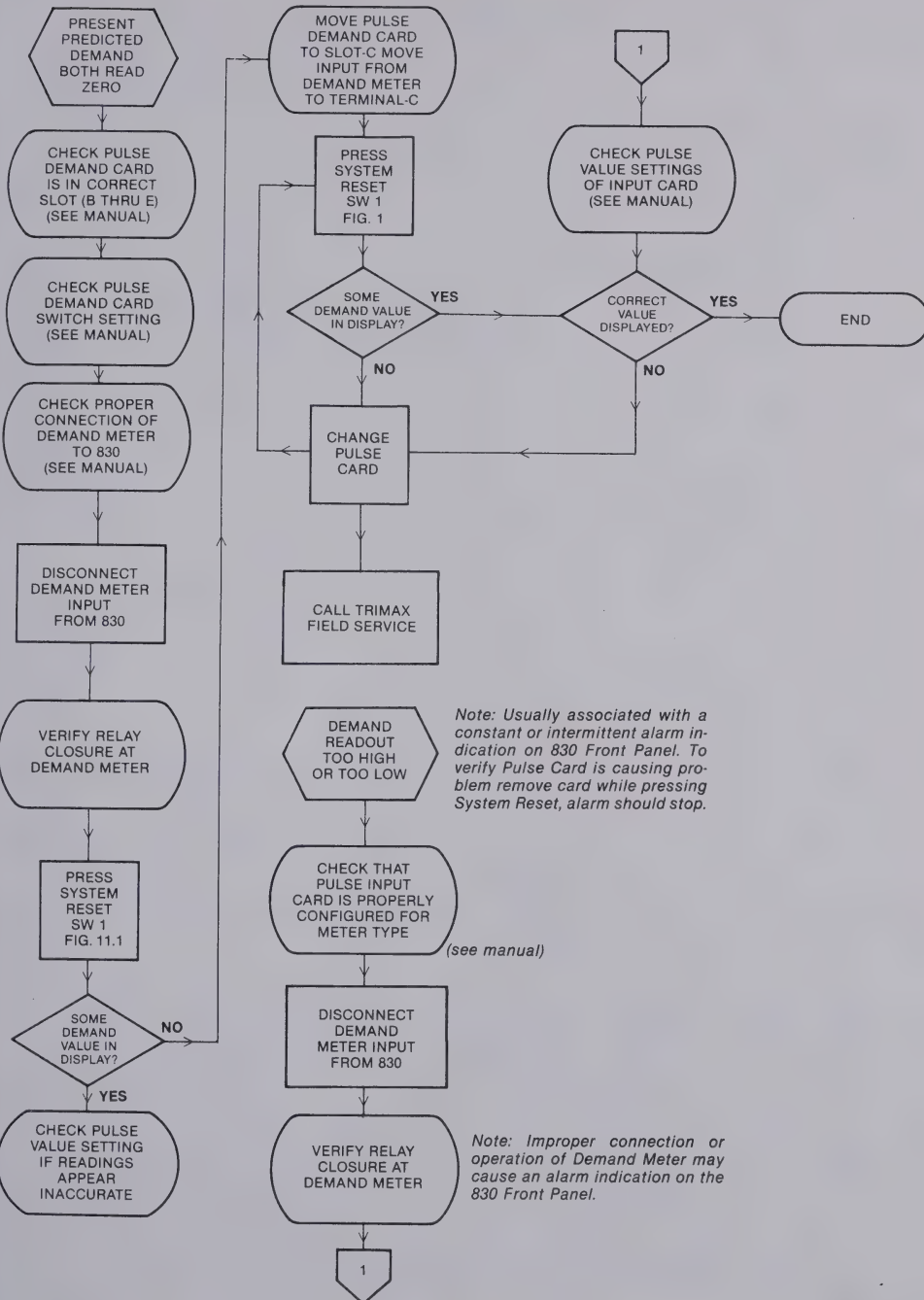
Note: Above conditions assumes the use of a Trimax Modem and Texas Instruments Silent 700 Printer.

Demand Input Analog Card



Note: Proper phase connections (see manual)

Demand Input Pulse Card

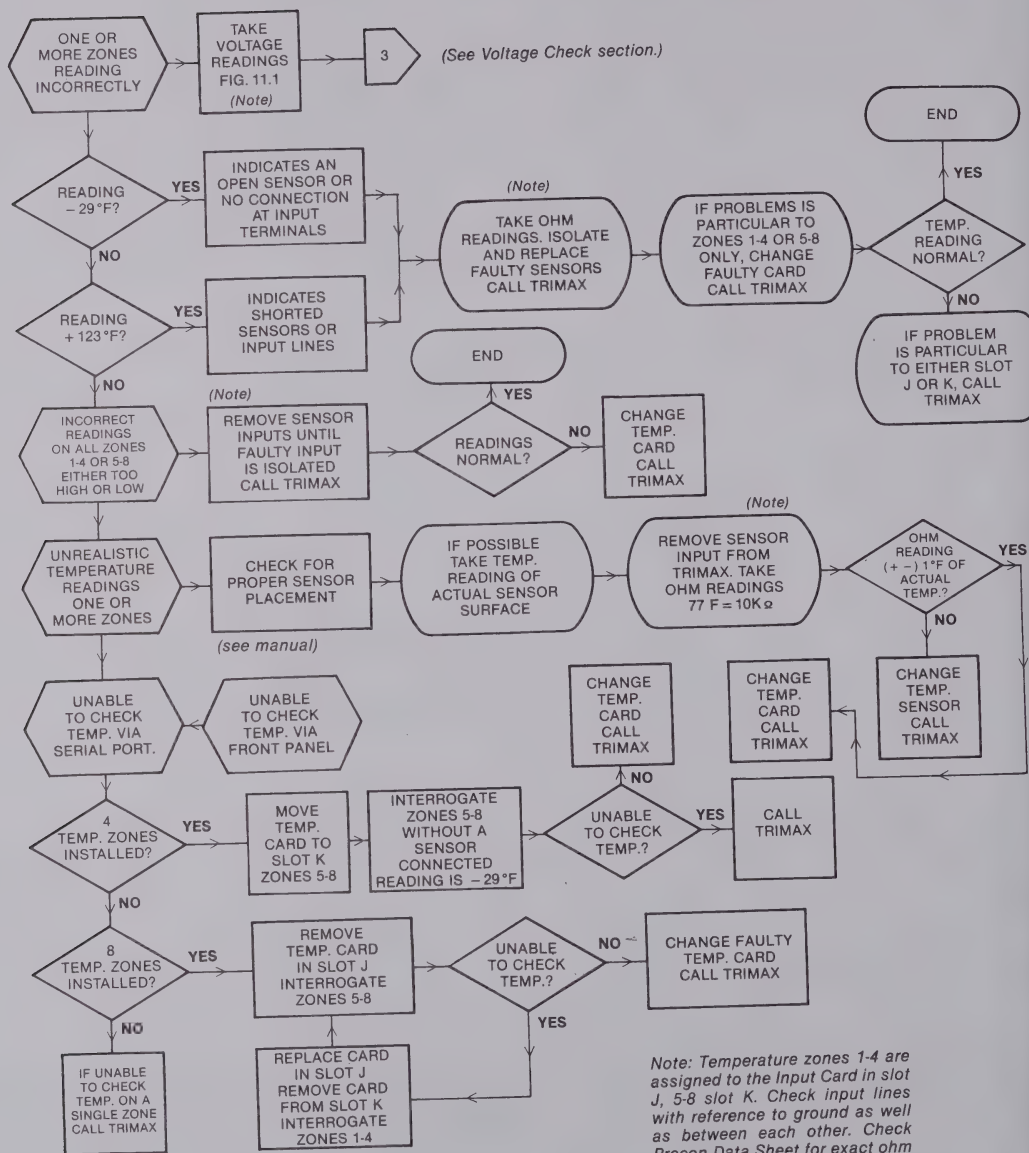


Note: Usually associated with a constant or intermittent alarm indication on 830 Front Panel. To verify Pulse Card is causing problem remove card while pressing System Reset, alarm should stop.

(see manual)

Note: Improper connection or operation of Demand Meter may cause an alarm indication on the 830 Front Panel.

Temperature Input Option



Trimax offers an auto-answer modem as an accessory to the Powersense 830. If the user supplies the modem, the unit selected must conform to the following specifications:

Baud Rate:	300
Bell Specification:	103 Compatible
Type:	Auto-answer
Serial Port:	RS-232C Asynchronous
Communication Mode:	Full Duplex

Whether Trimax or user-supplied, the modem should be mounted to the left of the Powersense 830 unit to minimize cable runs between the two units. The modem is supplied with a fixed-length 3-foot cable which is connected to the modem port via the top knockout.

The modem is susceptible to electromagnetic interference (EMI) from heavy loads. It is strongly recommended that the modem and the Powersense 830 unit be located as far away as conveniently possible from large breaker panels, cable trays, transformers, large contactors, etc. The modem is supplied with its own low voltage (24V) transformer.

An installed modem is pictured in figure 9.2.

To mount and install the modem unit, follow the steps outlined below.

1) Position the modem so that the LEDs and control switch are on the top and the manufacturer and logo information can be read by a person standing directly in front of the Powersense 830 unit. The modem will be vertically mounted on the wall in this position.

2) Remove the three Allen type screws on the modem. The screws are located on each side and the bottom of the modem.

3) Slide the cover upwards and off.

4) Position the cover against the wall and mount it on the wall using 2 screws.

5) Under the modem cover, adjacent to the cable connector, you will notice a block containing 8 switches. These switches will be of two types, either a lever toggle switch with markings of ON/OFF numbered 1-8, or a rocker type switch with a + marked for the ON position numbered 1-8. Ensure that all 8 switches are set to the OFF (or minus) position. (Switch #8 may be incorrectly set and, if so, will prevent the 830 from "hanging up" the line when the dialogue is finished.)

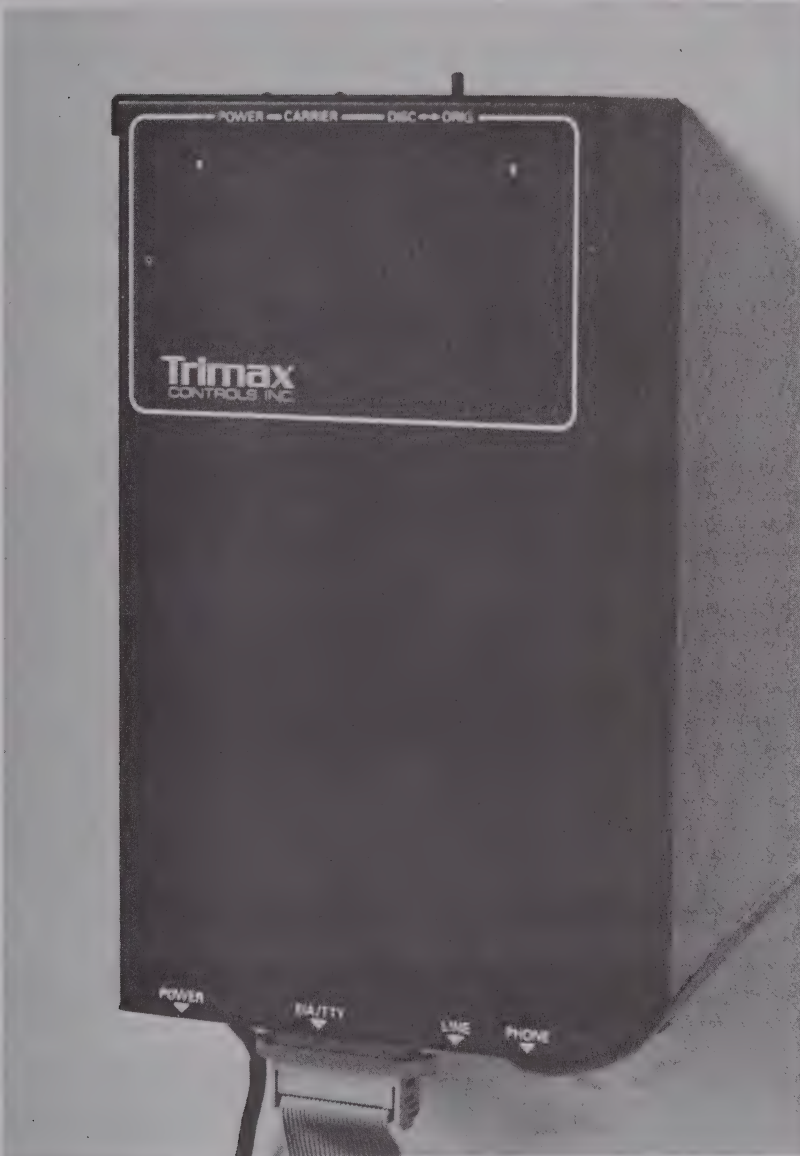


Figure 9.2: Auto Answer Modem Installed

6) Slide the modem back into the cover, carefully positioning the unit's disconnect/originate switch and two LEDs through the hole on the cover.

7) Replace the three Allen screws.

8) Plug in the transformer to the nearest electrical outlet.

The two lights on the top of the unit, when lit, indicate POWER ON and CARRIER PRESENT. The latter is lit whenever the EBC (and modem) are in communication with a computer, terminal, etc. via the telephone line.

9.5 Telephone Connection

The modem requires a direct telephone line or an extension. The direct line is preferable because of possible line noise. Also, a switchboard may be involved if an extension is used, thereby precluding any calls to the unit during non-business hours when a PBX operator may not be present. An actual telephone is not required.

A second telephone line should be installed if the facility has only one direct telephone line. If the same line is used for both, the telephone can be used for outgoing calls, however the auto-answer modem will always automatically answer all incoming calls on the first ring.

The user should inform the telephone company that a direct line (with a dedicated number) is required. If a new line is installed, it should be terminated as closely as possible to the modem. The telephone company should be informed that a RJ11C type connector (a female-type connector identical to that on the modem) is required for connection to the modem. A male/male connector cable is supplied with the modem to connect the telephone termination to the input of the modem.

A telephone handset is not required at the installation, but one may be connected at the discretion of the user. If a telephone instrument is used, it should be connected to the RJ11C connector of the modem labeled "PHONE" or "TELEPHONE OUT". The telephone company will request the FCC registration number and the ringer equivalence. They are:

FCC Registration number: APD9RA-69163-DM-N

Ringer Equivalence: 0.1B

9.6 User Terminal (TI Silent 700)

The user terminal may be one of a variety of configurations: a keyboard/printer, TTY-type printer, or CRT terminal. The printing type terminal, whether impact or non-impact, provides a hardcopy printout, which may be retained for future reference, of all transactions between the user and the Powersense 830.

To provide hardcopy capability, Trimax supplies a Texas Instruments Silent 700 (Model 745) with an integrated acoustical coupler. However, the user may elect to use a CRT-type terminal alone or in conjunction with a hardcopy printer. If the terminal or CRT is user supplied, the specifications of the unit must be as follows:

Baud Rate:	300
Number of Stop Bits:	1
Number of Start Bits:	1
Parity:	Even
Mode:	Full Duplex
Character Set:	64 ASCII
Number of Columns:	80

The terminal selected must be connected in some manner to the telephone lines. This may be done via an acoustic coupler, either integrated in the terminal or standalone, or via a direct connect modem.

The following information assumes the user has ordered and is using the Trimax-supplied Model 745 teleprinter with integrated acoustical coupler. It is also assumed the unit will be used in the telephone communications environment. Modifications will be required if the Model 745 terminal is used as a direct connect terminal.

To configure the Trimax-supplied terminal, follow the steps below:

- 1) Read the user's manual supplied with the unit. Refer to TI 984024-9701.
- 2) Follow the instructions on loading paper.
- 3) Set the unit's switches as follows:
 - a) Locate the "NUM" switch in the lower lefthand corner on the front of the unit and press the switch on the right side.

b) On the far righthand side, locate the "LOW SPEED", "HALF DUP", and "ON-LINE" switches.

c) Press the "LOW SPEED" switch on the right side.

d) Press the "HALF DUP" switch on the right side.

e) Press the "ON-LINE" switch on the left side.

These switch settings are the same for all terminal operations with the Powersense 830.

4) The power switch is located on top of the unit at the extreme rear on the right side. When switched On, the system will reset itself and force a carriage return to the far left side of the unit.

5) Dial the telephone number to which the auto-answer modem is connected.

6) Wait for the modem to answer. (You will hear a loud, shrill tone.)

7) Within 15 seconds, place the receiver in the acoustical cups in the rear of the teleprinter, noting the raised telephone signature

on the unit near the cups which displays the proper placement. (The mouthpiece goes in the left cup.) If the procedure is not completed within 15 seconds, the modem hangs up automatically. If the procedure is successful, within 5-10 seconds the small green LED under the SHIFT key to the left side of the ON-LINE switch will light.

8) Press the RETURN key. The 83C will then respond with location and prompt information.

 Note

If you have pressed RETURN and the unit appears not to be functioning, double check that you have set the ON-LINE switch to its proper position.

There are two indications of failure to establish communications. If the green carrier light does not light, it indicates the connection was not made. If the unit fails to respond to the RETURN, try pressing the key repeatedly. If it still doesn't respond, hang up and redial the telephone number to restart the procedure.

9.7 User Dialogue and Report Generation

This section describes the user dialogue with the Powersense 830. It covers the sign-on procedure, the STATUS, CHECK, and CHANGE operations, full and abbreviated dialogues, and the sign-off procedure. Several general rules apply throughout the communications dialogue, allowing recovery from erroneous entries, stopping long printouts, etc. These general rules are described first.

9.7.1 General Rules

There are seven general rules which apply to the overall operation of the user dialogue with the Serial Communication Option.

1) Carriage Return. All user entries must be terminated by pressing the RETURN (carriage return) key. (On the terminal supplied by Trimax, this is a bright orange key on the right side of the keyboard.) Pressing RETURN signals the Powersense 830 that

the current line of response is complete and the unit may process the information on that line. The Powersense 830 will take no action on any entry until the RETURN key is pressed.

2) First Recognizable Characters. During all phases of the communication dialogue, the Powersense 830 examines the first three characters of each response/entry (except for ON/OFF times and dates) up to the next comma or carriage return.

For example, when asked which option is to be selected (STATUS, CHECK, CHANGE or HISTORY?), the user need only enter STA for STATUS or HIS for HISTORY.

3) Five Minute "Time Out". After a user has properly signed on, he or she must type at least one key in any subsequent five (5) minute period or the Powersense 830 will "time out" and terminate the dialogue by typing:

TIME OUT

GOODBYE

The 830 will then hang up the telephone; re-dialing will be necessary to re-establish communications.

4) Deleting Previous Character. If a character is mistyped, it is possible to "erase" the character by holding down the SHIFT key and simultaneously pressing the character O. An underscore will

appear next to the mistyped character; however, the system will recognize that the previously entered character has been deleted. As an example:

TRIN_MAX
 ↑
 |____Created by pressing SHIFT O

would be interpreted as TRIMAX. This procedure may be done as many times as necessary to "back-up" to the incorrect character. Attempting to back-up past the first character of the line has no effect.

5) Deleting Current Line. If, for some reason, it is determined that a current line has been incorrectly entered, the entire line can be deleted/erased by pressing the SHIFT key and character I simultaneously. A backslash character ("\\") will appear. The system automatically performs a carriage return and line feed. A new line of characters may then be entered. For example:

TRIMAC CONTROLS IC\
 ↑
 |____Created by pressing SHIFT L

[RETURN]
(line feed)

(Ready for new entry)

If a RETURN is entered before the erroneous entry is discovered, the only way the line may be corrected is to continue with the sequence in progress, re-initiate the sequence and reenter the correct information.

6) Suspending Printout. To temporarily suspend the printout of a lengthy report press the "CTRL" key and the "S" key simultaneously at any time during the printing process. The 830 will finish the line in progress and withhold further output until the "CTRL-S" sequence is re-entered. (This feature is particularly useful if the central terminal is a CRT without printing capability.)

7) Terminating Printout. If the Powersense 830 is requested to print a lengthy list of information (e.g., ON/OFF times or duty cycle values) it may be interrupted by pressing the character "U". The unit will complete the next one or two lines and then it will repeat the last prompt printed (e.g., STATUS, CHECK, CHANGE or HISTORY?).

9.7.2 Sign-On Procedure

Initially, the Powersense 830 should be configured with a site location and the password to be used for subsequent CHANGE operations via the Serial Communication Option.

Upon pressing the RETURN key, the system will respond with:

POWERSENSE 830, REV 4.00

LOCATION: NONE GIVEN

STATUS, CHECK, CHANGE OR HISTORY?

Upon recognition of a signed-on user, the Powersense 830 immediately terminates any user activity from the front panel and a "C" will appear as the right most character in the lower display window of the unit. The front panel will remain in the this mode until either (1) the loss of carrier is detected or (2) the terminal operator presses the ESC key in response to a prompt. In the event that a local (front panel) user is in the process of entering or changing schedule data when the communications sequence is initiated, the Model 830 data entry keys will lock up and no further front panel operations will be possible until the completion of the communications dialogue.

To enter the Powersense 830 location, the user must respond to the STATUS prompt:

STATUS, CHECK, CHANGE OR HISTORY? LO

The system will return the prompt:

DESCRIBE LOCATION

The user may then enter up to 48 alphanumeric characters, including spaces and carriage returns as in the following example:

DESCRIBE LOCATION (prompt)

TRIMAX :

1180 MIRALOMA WAY : (entry)

SUNNYVALE, CA :

If the location is longer than the 48 character limit, the unit will acknowledge in this manner:

DESCRIBE LOCATION

TRIMAX CONTROLS, INC. <RETURN>

1180 MIRALOMA WAY <RETURN>

SUNNYVA

(System interrupts)

DESCRIPTION TOO LONG

DESCRIBE LOCATION

After entering the location data, press RETURN as the first character of the next line. The system responds with

ENTER?

Respond by pressing Y for yes, N for no. If the N is entered, the system will respond with:

DESCRIBE LOCATION

Awaiting the location to be re-entered.

If Y is entered, the location is set. The system will respond with:

STATUS, CHECK, CHANGE, OR HISTORY?

To see that the location has been entered properly, press ESC (the escape key). The system will respond with:

GOOD-BYE

and hang up the phone. Redial the number and press RETURN to generate the sequence again:

[Return]

POWERSENSE 830, REV 4.00

LOCATION: TRIMAX
1180 MIRALOMA WAY
SUNNYVALE, CA

STATUS, CHECK, CHANGE, OR HISTORY?

Notice that the system printed the location information this time.

For the next portion of the initial set-up and sign-on procedure, the PASSWORD must be set. To do so, the following response is required:

STATUS, CHECK, CHANGE, OR HISTORY? CHA

PASSWORD? (PROMPT)

By attempting to access the Powersense 830 from a central site through the CHANGE/ENTER/CANCEL function, a password is required. The password is a combination of three alphanumeric characters. The factory setting for the password is 000 (zero-zero-zero).

To set your password, enter 000, followed by your new three alphanumeric character password and then press RETURN. The characters entered for the password are not echoed to the terminal. For example, if 000ABC were entered in response to the password prompt, the unit would then recognize only ABC as the password during all succeeding change procedures. The password may be changed again at any time desired by entering the old password, followed by three new alphanumeric characters and a RETURN.



Use extreme caution when changing the password. As the characters are not printed when they are typed, it is important to know exactly which characters were entered

as the password. Also ensure that only 3 or 6 characters are typed when responding to the PASSWORD? prompt.

It is important to note the new password, as the loss of the password will prevent access to the CHANGE function via the Serial Communication port.

 Note

There are two ways to recover from a lost password. The preferred method is to contact the Trimax factory to reset the password to ~~000~~ over the telephone lines. You can remove the battery from the Powersense 830 and remove power from the unit for 2 minutes. Upon restoration of battery and 24VAC power, the unit will again have ~~000~~ as the password. However, all information previously resident in the unit will be lost and the unit will have to be completely reprogrammed.

If an improper password is entered, the system will respond:

PASSWORD?

NO

GOOD-BYE

and hang up the phone line. Redialing will be necessary in order to re-establish communications.

9.7.3 Full/Abbreviated Dialogue

The Powersense 830 provides both fully prompted user dialogue and an abbreviated version. These dialogues are demonstrated more completely under section 9.9, "CHANGE"; however, since the user may be programming a previously unprogrammed unit, a short example is provided here:

STATUS, CHECK, CHANGE, OR HISTORY? CHA

PASSWORD? _ _ _

FULL OR ABBREV MODE? F

"F" is the response for the fully prompted dialogue. As a practical example, a clock change or new setting is demonstrated in the FULL MODE (user responses underlined):

FULL OR ABBREV MODE? F

SCHED,CLOCK,TIMER,DU/CY,HOL,SET,MIN,PRIOR,PEAK,OPT,TDC,TSP, STD,DLS,
OR ALARM?

CLTIME? 110PDAY? MONSTD OR ELS? STDDATE? 112982ENTER? Y

CHANGE FUNCTION? (etc.)

 Note

In the CHANGE mode the system will prompt only "CHANGE FUNCTION" after the initial "SCHED, CLOCK, TIMER, etc" prompt.

Anyone who has programmed or used the Powersense 830 for any length of time will recognize the full prompting dialogue as the same information required from the front panel. Because normal use will provide enough familiarity for the user to memorize each routine, an abbreviated programming routine is made available:

STATUS, CHECK, CHANGE, OR HISTORY? CHA

PASSWORD? _ _ _ _

FULL OR ABBREV MODE? ACOMMAND? CL/110P/MON/STD/112982 [RETURN]

9.7.4 STATUS

A STATUS report of all schedules and operational features of the Powersense 830 can be generated by the user.

To request a STATUS report, enter "S" in response to the STATUS line prompt:

STATUS, CHECK, CHANGE, OR HISTORY? S

The status report will list all of the circuits and operational information which can be extracted from the Powersense 830 front panel as shown in figure 9.3.

Concentrating on the first three lines:

10:41A STD MONDAY 2/01/82

TIMER: 1:20 SETPOINT NO.: 1

PRESENT DEMAND: 1238 PREDICTED DEMAND: 1234 SETPOINT LEVEL: 1000

The first line indicates the time and date the STATUS report was initiated. The second line reports a non-zero Timer value and the

STATUS,CHECK,CHANGE, OR HISTORY? S

10:41A STD MONDAY 2/01/82

TIMER: 1:20 SETPOINT NO.: 1

PRESENT DEMAND: 1238 PREDICTED DEMAND: 1234 SETPOINT LEVEL: 1000

ALARMS

WATT METER FAULT
CIRCUIT FAULT
ALARM LEVEL EXCEEDED
SETPOINT EXCEEDED
ALL CIRCUITS SHED
LOW BATTERY

CKT

NO. STATUS

1	ON
2	SHED
3	SHED
4	SHED
5	OFF
6	SHED
7	SHED
8	SHED
9	OFF
10	OFF
11	ON
12	ON
13	ON
14	ON
15	ON
16	ON -T
17	OFF
18	ON -T
19	OFF
20	ON -T
21	OFF
22	ON -T
23	OFF
24	ON -T
25	OFF
26	ON -T
27	ON -O
28	ON -O
29	OFF -O
30	ON -T

PENDING

HOLIDAYS

FRIDAY

TIME CHANGE PENDING: NONE

STATUS,CHECK,CHANGE, OR HISTORY?

Figure 9.3: STATUS Report

selected setpoint. The third line shows the information currently displayed in the PRESENT DEMAND and PREDICTED DEMAND windows on the Powersense 830 front panel. These, along with the SETPOINT LEVEL value, will be non-zero only if the demand limit control option is installed in the Powersense 830.

The next items of information provided by the STATUS report are the ALARMS:

ALARMS

WATT METER FAULT

CIRCUIT FAULT

ALARM LEVEL EXCEEDED

SETPOINT EXCEEDED

ALL CIRCUITS SHED

LOW BATTERY

These alarms correspond to the alarm indicators on the Powersense 830 front panel. The following is a brief description of each alarm:

WATT METER FAULT: There is a possible short or broken wire in the connection from the 3-wire pulse-initiating demand meter to the Powersense 830. (Note: This message will occur if a 2-wire hookup is used between the pulse-initiating demand meter and the 830, and the blue J01 jumper is not removed from the Demand Input Pulse Card.

CIRCUIT FAULT: There is a Remote Load Sense fault occurring. One of the Circuit Master Cards is receiving a switch closure that is inconsistent with the programmed conditions of the load. It will be one of the circuits in the STATUS report designated with by "-0", an override. In this example, the circuit fault may be caused by one, two, or all three of the so designated circuits (27,28,29).

ALARM LEVEL EXCEEDED: The ALARM LEVEL EXCEEDED light is currently flashing on the Powersense 830 front panel.

SETPOINT EXCEEDED: The SETPOINT LEVEL, noted at the top of the report, has been exceed by the present demand, which is also indicated at the top of the report.

ALL CIRCUITS SHED: All loads presently available for shedding have been shed at the present time under the preprogrammed priority arrangement.

LOW BATTERY: Either the 9V alkaline battery (on the backside of the door) for the Powersense 830 or the battery on the Data Logging Card (if installed) must be replaced.

The next group of information on the STATUS report is the circuit status:

CKT NO.	STATUS

1	ON
2	SHED
3	SHED
4	SHED
5	OFF
6	SHED
.	
.	
.	
26	ON -T
27	ON -O
28	ON -O
29	OFF -O
30	ON -T

The report provides the ON/OFF status of the circuits for which there is a Circuit Master Card in place. Slots that do not have a Circuit Master Card installed will not appear on the report.

The designation -T indicates the circuit is operating under either the Timer or Timed Override Option. The designation -O indicates the circuit has been manually overridden to its current state or is presently in a Remote Load Sense fault condition.

The next two groups of information reported are:

PENDING

HOLIDAYS

FRIDAY

TIME CHANGE PENDING : NONE.

In the example here, Friday has been programmed in the Powersense 830 as a holiday, and the Friday light on the front panel is flashing. On Friday, the unit will switch over to one of the two special day schedules.

TIME CHANGE PENDING will normally be displayed as NONE. However, as the unit approaches a time changeover from Standard Time to Daylight Savings Time, or vice versa, the appropriate code is displayed: STD or DLS.

9.8 CHECK

The sample CHECK report generated by the user response ALL in Figure 9.4 will be used as the basis for discussion on all individual function information.

By responding CHE to the STATUS line prompt, the following line is generated:

```
ALL,SCHED,TIMER,DU/CY,HOL,SET,MIN,PRIOR,PEAK,OPT,TEMP,TDC,TSP,STD,  
DLS,OK ALARM?
```

ALL

The report may be quite lengthy and the user may terminate it at any point desired by pressing "U". As ALL produces such a lengthy report, the function has been designed so that the user can call up reports on individual functions within the system. Figure 9.5 summarizes the steps to manipulate individual functions. The underscore indicates user response. The individual reports are described more fully in later subsections of this chapter. Note that these reports are available when the system has been placed in the CHECK mode and the system responds with "ALL, SCHED..." or "CHECK FUNCTION?"

Figure 9.4: CHECK ALL Report

CHECK FUNCTION? ALL

4:41P DLS FRIDAY 6/17/83

CKT NO.	SCHED NO.	OPER- ATION	MON	TUE	WED	THUR	FRI	SAT	SUN	SPEC 1	SPEC 2
1	1	ON OFF	7:30A 5:20P	7:30A 5:20P	7:30A 5:20P	7:30A 5:20P	7:30A 5:20P				
2	1	ON OFF	7:30A 9:00A	7:30A 9:00A	7:30A 9:00A	7:30A 9:00A	7:30A 9:00A				
	2	ON OFF	9:00A 5:20P	9:00A 5:20P	9:00A 5:20P	9:00A 5:20P	9:00A 5:20P				
3	1	ON OFF	7:30A 9:05A	7:30A 9:05A	7:30A 9:05A	7:30A 9:05A	7:30A 9:05A				
	2	ON OFF	9:05A 5:20P	9:05A 5:20P	9:05A 5:20P	9:05A 5:20P	9:05A 5:20P				
4	1	ON OFF	7:30A 9:10A	7:30A 9:10A	7:30A 9:10A	7:30A 9:10A	7:30A 9:10A				
	2	ON OFF	9:10A 5:20P	9:10A 5:20P	9:10A 5:20P	9:10A 5:20P	9:10A 5:20P				
6	1	ON OFF	4:30A 7:30A	4:30A 7:30A	4:30A 7:30A	4:30A 7:30A	4:30A 7:30A	4:30A 7:30A			
7	1	ON OFF	3:30A 7:30A	3:30A 7:30A	3:30A 7:30A	3:30A 7:30A	3:30A 7:30A				
8	1	ON OFF	4:00A 7:30A	4:00A 7:30A	4:00A 7:30A	4:00A 7:30A	4:00A 7:30A	4:00A 7:30A			
10	1	ON OFF	5:00P 10:00P	5:00P 10:00P	5:00P 10:00P	5:00P 10:00P	5:00P 10:00P				
11	1	ON OFF	6:30A 12:00A	6:30A 12:00A	6:30A 12:00A	6:30A 12:00A	6:30A 12:00A				
	2	ON OFF	1:00P 5:10P	1:00P 5:10P	1:00P 5:10P	1:00P 5:10P	1:00P 5:10P				
	3	ON OFF	10:01P 5:00A	10:01P 5:00A	10:01P 5:00A	10:01P 5:00A	10:01P 5:00A	10:01P 5:00A	10:01P 5:00A	10:01P 5:00A	
12	1	ON OFF	6:30A 6:00P	6:30A 6:00P	6:30A 6:00P	6:30A 6:00P	6:30A 6:00P				
	2	ON OFF	10:00P 5:00A	10:00P 5:00A	10:00P 5:00A	10:00P 5:00A	10:00P 5:00A	5:00A 5:00A	5:00A 5:00A		
13	1	ON OFF	6:30A 6:00P	6:30A 6:00P	6:30A 6:00P	6:30A 6:00P	6:30A 6:00P				
	2	ON OFF	10:00P 5:00A	10:00P 5:00A	10:00P 5:00A	10:00P 5:00A	10:00P 5:00A	5:00A 5:00A	5:00A 5:00A		
14	1	ON OFF	6:30A 9:45A	6:30A 9:45A	6:30A 9:45A	6:30A 9:45A	6:30A 9:45A				
	2	ON OFF	10:00A 11:30A	10:00A 11:30A	10:00A 11:30A	10:00A 11:30A	10:00A 11:30A				
	3	ON OFF	12:00A 2:30P	12:00A 2:30P	12:00A 2:30P	12:00A 2:30P	12:00A 2:30P				
	4	ON OFF	2:45P 4:00P	2:45P 4:00P	2:45P 4:00P	2:45P 4:00P	2:45P 4:00P				
	5	ON OFF	10:00P 5:00A	10:00P 5:00A	10:00P 5:00A	10:00P 5:00A	10:00P 5:00A	5:00A 5:00A	5:00A 5:00A		
	6	ON OFF	4:30P 6:10P	4:30P 6:10P	4:30P 6:10P	4:30P 6:10P	4:30P 6:10P				
16	1	ON OFF	7:00A 5:00P	7:00A 5:00P	7:00A 5:00P	7:00A 5:00P	7:00A 5:00P				
	2	ON OFF	7:00A 9:00A	7:00A 9:00A	7:00A 9:00A	7:00A 9:00A	7:00A 9:00A				

17	1	DN	6:30A	6:30A	6:30A	6:30A	6:30A						
		OFF	5:00P	5:00P	5:00P	5:00P	5:00P	5:00P					
	2	DN	7:00A	7:00A	7:00A	7:00A	7:00A	7:00A					
		OFF	9:00A	9:00A	9:00A	9:00A	9:00A	9:00A					
18	1	DN	7:00A	7:00A	7:00A	7:00A	7:00A	7:00A					
		OFF	5:00P	5:00P	5:00P	5:00P	5:00P	5:00P					
19	1	DN	7:30A	7:30A	7:30A	7:30A	7:30A	7:30A					
		OFF	5:00P	5:00P	5:00P	5:00P	5:00P	5:00P					
20	1	DN	12:01A	12:01A	12:01A	12:01A	12:01A	12:01A	12:01A	12:01A	12:01A	12:01A	12:01A
		OFF	12:01A	12:01A	12:01A	12:01A	12:01A	12:01A	12:01A	12:01A	12:01A	12:01A	12:01A
31	1	DN	8:00A	8:00A	8:00A	8:00A	8:00A	8:00A					
		OFF	5:00P	5:00P	5:00P	5:00P	5:00P	5:00P					
32	1	DN	5:00P	5:00P	5:00P	5:00P	5:00P	5:00P					
		OFF	10:00P	10:00P	10:00P	10:00P	10:00P	10:00P					
33	1	DN	10:00P	10:00P	10:00P	10:00P	10:00P	10:00P					
		OFF	5:00A	5:00A	5:00A	5:00A	5:00A	5:00A					
34	1	DN	5:00A	5:00A	5:00A	5:00A	5:00A	5:00A					
		OFF	8:00A	8:00A	8:00A	8:00A	8:00A	8:00A					
35	1	DN							5:00A	5:00A	5:00A	5:00A	
		OFF							5:00A	5:00A	5:00A	5:00A	

ZONE	TIME		TIMER	CKTS
	REM.	VALUE		
0	0:35	1:30	16	
			18	
			20	
			22	
			24	
			26	
1	0:00	0:45	11	
			13	
2	0:00	0:30	12	
3	0:00	0:30	14	
4	0:00	0:25	23	
			25	
5	0:00	2:00	15	
6	0:00	0:40	17	
			19	
			21	

CKT NO.	SCHED NO.	DUTY		CYCLE
		ON	OFF	
2	1	0:20	0:10	
3	1	0:20	0:10	
4	1	0:20	0:10	

Figure 9.4: Continued

HOLIDAY NO.	TYPE	DATE	NO. DAYS
2	1	7/04/83	1
3	1	8/06/83	1
4	1	9/05/83	1
5	1	11/25/83	2
6	1	12/23/83	2
7	1	12/30/83	2
8	1	2/21/84	1
9	1	5/30/84	1

SETPOINT NO.	KW	DEAD BAND	INT- ERVAL
1	1000	200	0:15
2	1400	200	0:15
3	1300	200	0:15
4	1200	200	0:15
5	1100	200	0:15

CKT NO.	MIN SHED	MAX SHED	MIN ON
2	0:05	0:20	0:07
3	0:05	0:20	0:07
4	0:05	0:20	0:07
6	0:15	1:00	0:00
7	0:15	1:00	0:00
8	0:15	1:00	0:00

CKT
NO. PRIORITY

2	31
3	32
4	33
6	1
7	3
8	2

SETPOINT NO.	PEAK KW	DATE	TIME	MWH USED	RESET DATE	RESET TIME
1	1274	3/11/82	12:00A	7	3/11/82	11:28A
2	1137	3/11/82	5:01P			
3	0	3/11/82	11:28A			
4	0	3/11/82	11:28A			
5	0	3/11/82	11:28A			

ZONE	SETBACK TEMP	OCCUPIED TEMP	CKTS
2	55	68	2♦
	85	76	2♦
3	55	68	3♦
	85	76	3♦
4	55	68	4♦
	85	76	4♦
5	55	68	16♦
7	55	68	17♦
			18

Figure 9.4: Continued

ZONE NO.	TEMP
1	56
2	75
3	75
4	76
5	73
6	74
7	74
8	110

CKT NO.	SCHED NO.	ZONE	BASE TEMP	DEAD BAND	MIN/ DEG
2	2	2	74	4	5
3	2	3	74	4	5
4	2	4	73	5	5

SETPOINT NO.	BASE TEMP	KW/ DEG
1	45	5
2	40	10
3	35	15
4	30	20
5	25	25

DLS TO STD ON 10/31/82

STD TO DLS ON 4/25/82

SETPOINT NO.	ALARM LEVEL
1	1000
2	1300
3	1100
4	1200
5	1000

CHECK FUNCTION?

Figure 9.4: Continued

Figure 9.5: Calling Up Individual Reports

CHECK MNEMONIC/			
<u>FUNCTION</u>	<u>User Enters</u>	<u>PROMPT</u>	<u>RESPONSE</u>
Schedule	SCHED <u>SC</u>	CIRCUIT NO.?	2-Digit Circuit No. Or <u>ALL</u>
Timer	TIMER <u>TI</u>	Report Produced	---
Duty Cycle	DU/CY <u>DU</u>	CIRCUIT NO.?	2-Digit Circuit No. Or <u>ALL</u>
Holiday	HOL <u>H</u>	Report Produced	---
Setpoint	SET <u>SE</u>	Report Produced	---
Min/Max Shed Minimum ON	MIN <u>MI</u>	CIRCUIT NO.?	2-Digit Circuit No. Or <u>ALL</u>
Circuit Priority	PRIOR <u>PR</u>	Report Produced	---
Peak Demand	PEAK <u>PE</u>	Report Produced	---

Optimal	OPT	Report	---
Start	<u>0</u>	Produced	
Temperature	TEMP	Report	---
	<u>TE</u>	Produced	
Temperature	TDC	CIRCUIT NO.?	2-Digit Circuit No.
Compensated	<u>TD</u>		Or <u>ALL</u>
Duty Cycle			
Temperature	TSP	Report	---
Compensated	<u>TS</u>	Produced	
Setpoint			
Standard	STD	Report	---
Time	<u>ST</u>	Produced	
Daylight	DLS	Report	---
Savings Time	<u>DL</u>	Produced	
Alarm Level	ALARM	Report	---
	<u>ALA</u>	Produced	

Figure 9.5: continued

9.8.1 SCHED Function

The first individual function which can be checked is the schedule (SCHED) for all active circuits as shown in Figure 9.6. The schedule report is requested by responding with SC to the CHECK prompt. In the example, circuits 1-11 are all single schedule loads. The first four circuits are connected to rooftop packaged units. The fifth circuit (CKT No. 5) has been omitted because there are no ON/OFF schedules entered for Circuit No. 5. Circuits 6-8 control hot water heaters, two of which operate on Saturdays. Circuit 10, which reports a 7-day and special day schedule, controls the plant's exterior night lights. Circuits 11 through 14 operate the facility's inside lights. Circuit 12 operates under two schedules, while Circuit 14 has been assigned four schedules. Note that the interior light ON/OFF schedules are staggered over the lunch hour to conserve energy.

Circuits 31-35 represent the possible multiple setpoint schedules. These are displayed only if both the Demand Control and Multiple Setpoint Options have been installed in the Powersense 830.

STATUS, CHECK, CHANGE, OR HISTORY? CHE

ALL, SCHED, TIMER, DU/ CY, HOL, SET, MIN, PRIOR, PEAK, OPT, TEMP, TDC, TSP, STD, DLS, OR ALARM?
ALL

4:38P DLS FRIDAY 6/17/83

CKT NO.	SCHED NO.	OPER- ATION	MON	TUE	WED	THUR	FRI	SAT	SUN	SPEC 1	SPEC 2
1	1	ON OFF	7:30A 5:20P	7:30A 5:20P	7:30A 5:20P	7:30A 5:20P	7:30A 5:20P				
2	1	ON OFF	7:30A 9:00A	7:30A 9:00A	7:30A 9:00A	7:30A 9:00A	7:30A 9:00A				
	2	ON OFF	9:00A 5:20P	9:00A 5:20P	9:00A 5:20P	9:00A 5:20P	9:00A 5:20P				
3	1	ON OFF	7:30A 9:05A	7:30A 9:05A	7:30A 9:05A	7:30A 9:05A	7:30A 9:05A				
	2	ON OFF	9:05A 5:20P	9:05A 5:20P	9:05A 5:20P	9:05A 5:20P	9:05A 5:20P				
4	1	ON OFF	7:30A 9:10A	7:30A 9:10A	7:30A 9:10A	7:30A 9:10A	7:30A 9:10A				
	2	ON OFF	9:10A 5:20P	9:10A 5:20P	9:10A 5:20P	9:10A 5:20P	9:10A 5:20P				
6	1	ON OFF	4:30A 7:30A	4:30A 7:30A	4:30A 7:30A	4:30A 7:30A	4:30A 7:30A	4:30A 7:30A			
7	1	ON OFF	3:30A 7:30A	3:30A 7:30A	3:30A 7:30A	3:30A 7:30A	3:30A 7:30A				
8	1	ON OFF	4:00A 7:30A	4:00A 7:30A	4:00A 7:30A	4:00A 7:30A	4:00A 7:30A	4:00A 7:30A			
10	1	ON OFF	5:00P 10:00P	5:00P 10:00P	5:00P 10:00P	5:00P 10:00P	5:00P 10:00P				
11	1	ON OFF	6:30A 12:00A	6:30A 12:00A	6:30A 12:00A	6:30A 12:00A	6:30A 12:00A				
	2	ON OFF	1:00P 5:10P	1:00P 5:10P	1:00P 5:10P	1:00P 5:10P	1:00P 5:10P				
	3	ON OFF	10:01P 5:00A	10:01P 5:00A	10:01P 5:00A	10:01P 5:00A	10:01P 5:00A	10:01P 5:00A	10:01P 5:00A	10:01P 5:00A	10:01P 5:00A
12	1	ON OFF	6:30A 6:00P	6:30A 6:00P	6:30A 6:00P	6:30A 6:00P	6:30A 6:00P				
	2	ON OFF	10:00P 5:00A	10:00P 5:00A	10:00P 5:00A	10:00P 5:00A	10:00P 5:00A	5:00A 5:00A	5:00A 5:00A		
13	1	ON OFF	6:30A 6:00P	6:30A 6:00P	6:30A 6:00P	6:30A 6:00P	6:30A 6:00P				
	2	ON OFF	10:00P 5:00A	10:00P 5:00A	10:00P 5:00A	10:00P 5:00A	10:00P 5:00A	5:00A 5:00A	5:00A 5:00A		

Figure 9.6: SCHED Report

14	1	ON	6:30A	6:30A	6:30A	6:30A	6:30A				
		OFF	9:45A	9:45A	9:45A	9:45A	9:45A				
	2	ON	10:00A	10:00A	10:00A	10:00A	10:00A				
		OFF	11:30A	11:30A	11:30A	11:30A	11:30A				
	3	ON	12:00A	12:00A	12:00A	12:00A	12:00A				
		OFF	2:30P	2:30P	2:30P	2:30P	2:30P				
	4	ON	2:45P	2:45P	2:45P	2:45P	2:45P				
		OFF	4:00P	4:00P	4:00P	4:00P	4:00P				
	5	ON	10:00P	10:00P	10:00P	10:00P	10:00P	5:00A	5:00A		
		OFF	5:00A	5:00A	5:00A	5:00A	5:00A	5:00A	5:00A		
	6	ON	4:30P	4:30P	4:30P	4:30P	4:30P				
		OFF	6:10P	6:10P	6:10P	6:10P	6:10P				
16	1	ON	7:00A	7:00A	7:00A	7:00A	7:00A				
		OFF	5:00P	5:00P	5:00P	5:00P	5:00P				
	2	ON	7:00A	7:00A	7:00A	7:00A	7:00A				
		OFF	9:00A	9:00A	9:00A	9:00A	9:00A				
17	1	ON	6:30A	6:30A	6:30A	6:30A	6:30A				
		OFF	5:00P	5:00P	5:00P	5:00P	5:00P				
	2	ON	7:00A	7:00A	7:00A	7:00A	7:00A				
		OFF	9:00A	9:00A	9:00A	9:00A	9:00A				
18	1	ON	7:00A	7:00A	7:00A	7:00A	7:00A				
		OFF	5:00P	5:00P	5:00P	5:00P	5:00P				
19	1	ON	7:30A	7:30A	7:30A	7:30A	7:30A				
		OFF	5:00P	5:00P	5:00P	5:00P	5:00P				
20	1	ON	12:01A	12:01A	12:01A	12:01A	12:01A	12:01A	12:01A	12:01A	12:01A
		OFF	12:01A	12:01A	12:01A	12:01A	12:01A	12:01A	12:01A	12:01A	12:01A
31	1	ON	8:00A	8:00A	8:00A	8:00A	8:00A				
		OFF	5:00P	5:00P	5:00P	5:00P	5:00P				
32	1	ON	5:00P	5:00P	5:00P	5:00P	5:00P				
		OFF	10:00P	10:00P	10:00P	10:00P	10:00P				
33	1	ON	10:00P	10:00P	10:00P	10:00P	10:00P				
		OFF	5:00A	5:00A	5:00A	5:00A	5:00A				
34	1	ON	5:00A	5:00A	5:00A	5:00A	5:00A				
		OFF	8:00A	8:00A	8:00A	8:00A	8:00A				
35	1	ON						5:00A	5:00A	5:00A	5:00A
		OFF						5:00A	5:00A	5:00A	5:00A

Figure 9.6: Continued

9.8.2 TIMER Schedule

If the Timed Override Option has been installed in the Powersense 830, a similar check of the circuits with timer values can be generated. This is accomplished by responding TI to the CHECK prompt. Figure 9.7 shows the report generated.

In this example, zone zero has a timer which allows the temporary time extension of ON times for circuits 16, 18, 20, 22, 24, 26 and 28. This report notes that all but 6 minutes of the original 1 hour, 30 minutes have already been used on the temporary time extension.

Zones 1-3 are under a pushbutton timer arrangement. These are used to temporarily activate circuits which have been switched OFF, such as for turning on lights and heating/cooling units when janitorial services come in at night or during the weekend. When the pushbutton is pressed, the circuits in that zone are switched ON for the length of time specified by the TIMER value.

CIRCUIT NO.?

CHECK FUNCTION? TI

7:02P STD THURSDAY 3/11/82

ZONE	TIME REM.	TIMER VALUE	CKTS
0	0:06	1:30	16 18 20 22 24 26 28
1	0:00	0:45	11 13
2	0:00	0:30	12
3	0:00	0:30	14
4	0:00	0:25	23 25
5	0:00	2:00	15
6	0:00	0:40	17 19 21

Figure 9.7: TIMER Report

9.8.3 DU/CY Schedule

Loads that are under a duty cycle schedule arrangement can be displayed by responding DU to the CHECK prompt. Figure 9.8 shows the report generated.

The DU/CY report lists the circuit number, schedule number and the Duty Cycle ON/OFF durations.

```

CHECK FUNCTION? DU

CIRCUIT NO.? ALL
CKT SCHED DUTY CYCLE
NO. NO.   ON   OFF
-----
  2   1   0:20 0:10
  3   1   0:20 0:10
  4   1   0:20 0:10

```

Figure 9.8: DU/CY Report

9.8.4 HOLIDAY Schedule

The Powersense 830 allows the scheduling of up to 30 holidays years in advance. The holidays that have been programmed into the unit can be listed by holiday number, the holiday type, the holiday date, and the number of consecutive days of the designated holiday period. The report is generated by entering HO. Listed in Figure 9.9 are several holidays that fall on a Monday in the current year, hence the number of consecutive days is set to one.

CHECK FUNCTION? HO

4:43P DLS FRIDAY 6/17/83

HOLIDAY NO.	TYPE	DATE	NO. DAYS
2	1	7/04/83	1
3	1	8/06/83	1
4	1	9/05/83	1
5	1	11/25/83	2
6	1	12/23/83	2
7	1	12/30/83	2
8	1	2/21/84	1
9	1	5/30/84	1

Figure 9.9: HOL Report

9.8.5 SETPOINT Schedule

If the Demand Control Option has been installed in the Powersense 830, the current value of Setpoint 1 in kilowatts, deadband, and

interval can be generated by entering SE in response to the CHECK prompt. If the Multiple Setpoint Option has also been installed, the values for up to five setpoints can be generated. Figure 9.10 shows the setpoint values generated under the SE response. The schedule for each setpoint is generated under the SCHED function (Circuits 31-35). Refer to subsection 9.7.6, "SCHED Function."

In this example, setpoint 1 with a setpoint level of 1000 is in effect from 8 a.m. - 5 p.m. Monday through Friday. At 5 p.m. on each of these days, setpoint 2, with a setpoint level of 1400, is used from 5 p.m. - 10 p.m. During the weekend and on special days, setpoint 5 with a setpoint value of 1100 is used 24 hours a day.

CHECK FUNCTION? SE

. 7:03P STD THURSDAY 3/11/82

SETPoint NO.	KW	DEAD BAND	INT- ERVAL
1	1000	200	0:15
2	1400	200	0:15
3	1300	200	0:15
4	1200	200	0:15
5	1100	200	0:15

Figure 9.10: SET Report

9.8.6 MIN/MAX Schedule

The Minimum Shed, Maximum Shed, and Minimum On times can be listed by responding with MI to the CHECK prompt. The report generated is shown in figure 9.11.

```
CHECK FUNCTION? M                                7:03P STD THURSDAY 3/11/82
CIRCUIT NO.? ALL

CKT  MIN  MAX  MIN
NO.  SHED SHED ON
---  ---  ---  ---
 2  0:05  0:20  0:07
 3  0:05  0:20  0:07
 4  0:05  0:20  0:07
 6  0:15  1:00  0:00
 7  0:15  1:00  0:00
 8  0:15  1:00  0:00
```

Figure 9.11: MIN/MAX Report

9.8.7 PRIORITY Report

If the Demand Control Option has been installed in the Powersense 830, the user can list the shed priority for all circuits by responding with PR to the CHECK prompt. The report generated is shown in figure 9.12.

The report generates a listing of each circuit under a sheddable priority arrangement and each circuit's actual priority (high to low) in the devised shedding scheme. In this example, circuits 6-8 -- hot water heaters -- would be the first loads shed. By referring back to the MIN/MAX information, note that the water heaters would be shed for a minimum of 15 minutes and for as long as one hour. The facility heating/cooling units are the highest priority loads and, therefore, the last loads shed under this arrangement.

CHECK FUNCTION? PR

7:03P STD THURSDAY 3/11/82

CKT NO.	PRIORITY
2	31
3	32
4	33
6	1
7	3
8	2

Figure 9.12: PRIOR Report

9.8.8 SETPOINT Peak Report

If the Demand Control Option has been installed in the Powersense 830, the peak observed demand can be recalled and listed as shown in Figure 9.13.

This example reports the peak value observed since the last meter reset date on March 11, 1982. Referring back to the information already presented on the setpoint values and schedules, Setpoint No. 1 has a value of 1000 and is operational from 8 a.m. - 5 p.m. Monday through Friday. The peak value observed under the Setpoint No. 1 schedule was 1358. It occurred on March 12, 1982 at 4:20 p.m. This presents a case where the setpoint value has been exceeded. For the remainder of the month, the user may wish to set Setpoint 1 to 1400 KW to lessen shedding, since a demand peak of 1358 KW has already been established.

From the report, the user can also determine that none of the other setpoint values has been exceeded since the last reset time and that there appears to be sufficient margin to safely maintain or decrease the current demand levels for setpoints 2-5.

Other information can be determined from the peak value report. For example, the peak value for Setpoint No. 2 occurred at 5 p.m., just as the loads were being turned off for the day at the end of the work day. The peak for Setpoint No. 4 was recorded at 7:45 a.m. -- the start of the business day. The peak for Setpoint No. 5 occurred at 7:43 a.m. on a Sunday, a rather high peak for a non-working day. This was recorded when the janitorial services

came in. Knowledge of these peak periods provides a fairly clear profile of a facility's operations and can be usefully applied to controlling excessive demand charges through accurate scheduling.

Another useful detail provided by the report is the total megawatt hours used by the facility since these values were last reset to zero. This is not only useful to predict utility costs for the upcoming month but also, if recorded and saved, allows the user a comparative base to track energy consumption either on a monthly or yearly basis.

CHECK FUNCTION? PE

4:13P STD MONDAY 3/15/82

SETPOINT NO.	PEAK KW	DATE	TIME	MWH USED	RESET DATE	RESET TIME
1	1358	3/12/82	4:20P	48	3/11/82	11:28A
2	1231	3/12/82	5:00P			
3	240	3/12/82	10:13P			
4	1073	3/15/82	7:45A			
5	616	3/14/82	7:43A			

Figure 9.13: PEAK Report

9.8.9 OPTIMAL START Report

If the Temperature Input Option has been installed in the Powersense 830, the user can generate a report of the circuits designated for Optimal Start as shown in figure 9.14.

CHECK FUNCTION? OP

4:44P DLS FRIDAY 6/17/83

ZONE	SETBACK TEMP	OCCUPIED TEMP	CKTS
2	55	68	2♦
	85	76	2♦
3	55	68	3♦
	85	76	3♦
4	55	68	4♦
	85	76	4♦
5	55	68	16♦
7	55	68	17♦
			18

Figure 9.14: OP Report

The Powersense 330 can maintain a facility profile in memory and, as it collects data points, provide a self-adjusting system to achieve the scheduled OCCUP TEMP by the time the facility personnel arrive for the day. The OPT START function also maintains a SETBACK TEMP, the temperature at which the facility will be maintained when the site is not normally occupied.

OPT START uses the difference between internal space temperature and external temperature along with the time needed to reach the desired inside temperature as inputs. For a more detailed explanation of the optimal start function, refer to Chapter 4 of this manual.

9.8.10 CURRENT TEMPERATURE Report

If the Temperature Input Option has been installed in the Powersense 830, the user can generate a report on the current temperature in each zone within the facility as shown in Figure 9.15.

Zone 1 is an outdoor temperature sensor which monitors ambient air temperature. Zone 2, which records an unusually warm temperature, is a special "warm room" at the Trimax factory used for equipment test prior to shipment.

CHECK FUNCTION? TE

7:04P STD THURSDAY 3/11/82

ZONE
NO. TEMP

1	55
2	74
3	75
4	75
5	73
6	74
7	74
8	111

Figure 9.15: TEMP Report

9.8.11 TEMPERATURE COMPENSATED DUTY CYCLE Report

If the Temperature Input Option has been installed in the Powersense 850, the user can designate specific circuits and their schedules for control under a Temperature Compensated Duty Cycle scheme. A typical report is shown in figure 9.16.

The Temperature Compensated Duty Cycle function allows the user to vary the duty cycle pattern as a function of either outside or inside ambient temperature. For full details on the Temperature Compensated Duty Cycle, refer to Chapter 4 of this manual.

CHECK FUNCTION? TD
CIRCUIT NO.? ALL

4:47P DLS FRIDAY 6/17/83

CKT NO.	SCHED NO.	ZONE	BASE TEMP	DEAD BAND	MIN/ DEG
2	2	2	74	4	5
3	2	3	74	4	5
4	2	4	73	5	5

Figure 9.16: TCD Report

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